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32 Desktops for
Any Season

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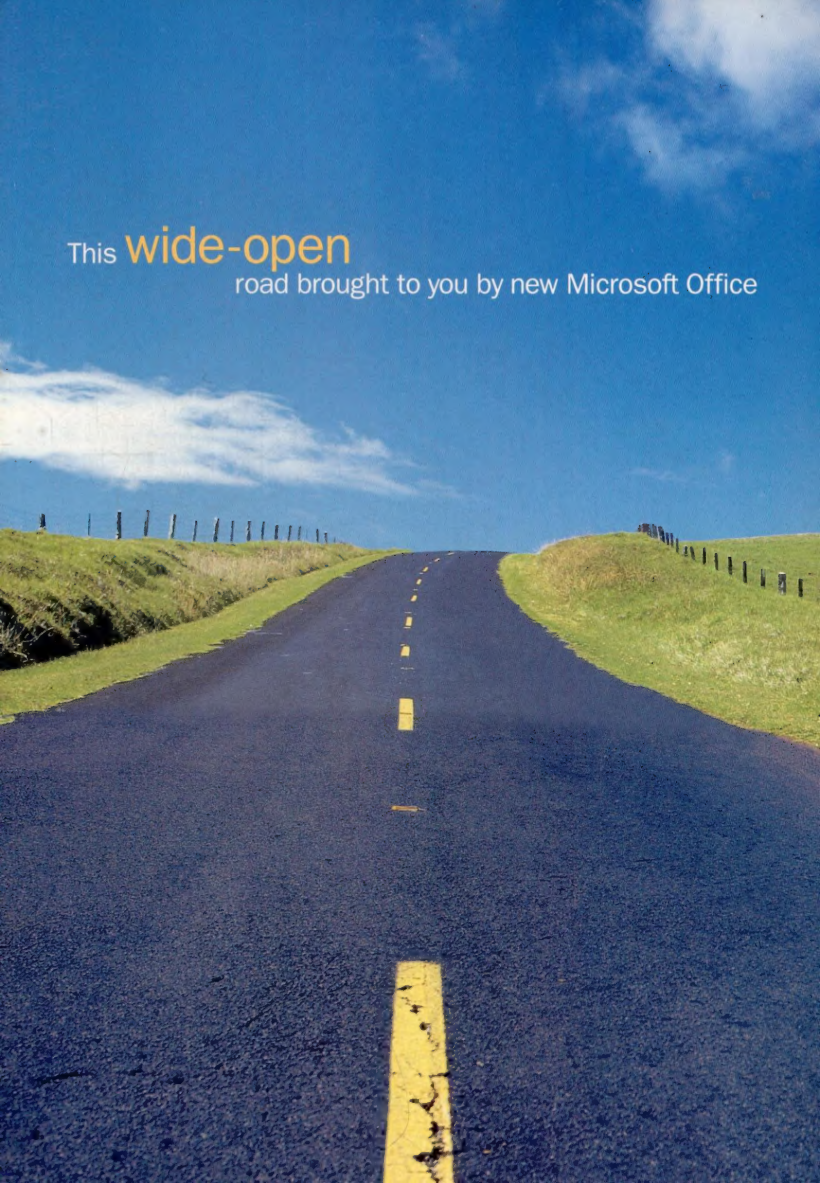
Low-Cost Adapters
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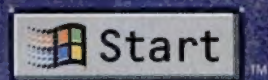
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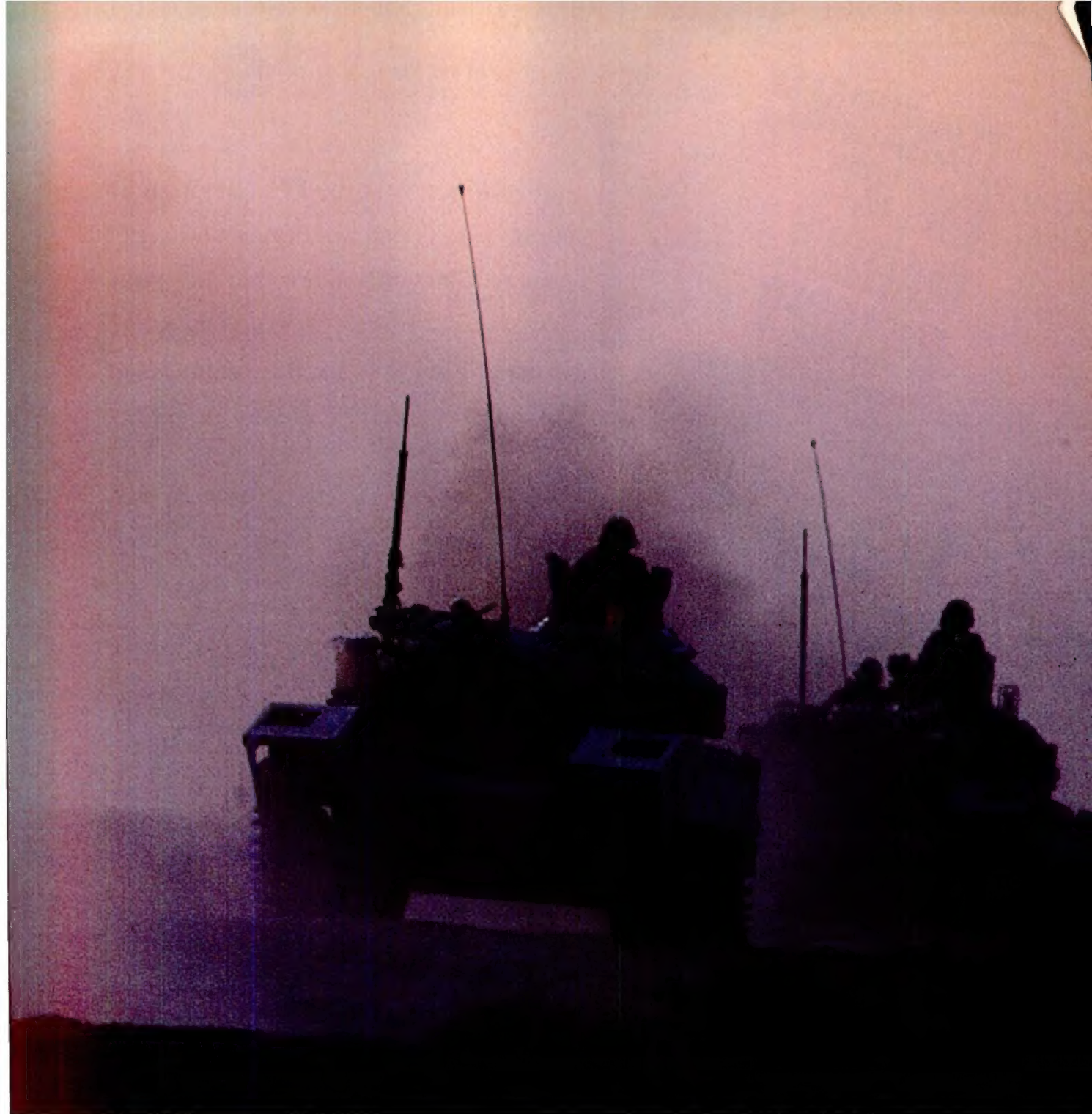


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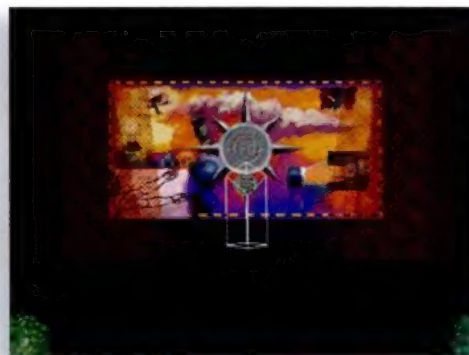
Inside

Innovation is what the PC industry is all about. Every year, we see new and better products, including a few that just make us marvel at the great ideas and the speed of innovation that are the hallmarks of the industry. And 1995 was no exception.

All this brings us to the 12th Annual Awards for Technical Excellence, where we again honor the products that we think represent the most important technical breakthroughs of the year. (Note that these are not necessarily our favorite products or our picks as the "best" products of the year; you will see that list in our next issue.)

We're also using some of this technology to give you a new view of our technical excellence awards. As usual, we're announcing the awards at a ceremony at Fall Comdex. Unfortunately, we can't invite all of you to Las Vegas, but we can invite you to an on-line equivalent, the virtual Technical Excellence Awards Gallery, which we developed in conjunction with Worlds Inc., a San Francisco-based virtual-reality designer that has created some impressive new worlds.

To get to the virtual gallery, you'll need to download special software from PC MagNet on CompuServe (GO EDITOR) or from our Web site ([http:// www.pcmag.com](http://www.pcmag.com)). There's no ad-



The "entrance" to PC Magazine's virtual Technical Excellence Awards gallery.

ditional charge for getting into the virtual Technical Excellence Awards Gallery for the first 30 days.

One of the things that's fun about working with PC Labs is that we're always trying out neat new things with our computers. It would be great if you could join us in our first virtual world. I hope to see you there.

—Michael J. Miller

PC Magazine, ISSN 0888-8507, is published twice a month except in July and August, for \$49.97 for one year. Ziff-Davis Publishing Company, L.P., One Park Ave., New York, NY 10016-5802. Second-class postage paid at New York, NY 10016-5802 and at additional mailing offices. POSTMASTER: Address changes to PC Magazine, P.O. Box 54093, Boulder, CO 80322-4093. GST registration number: R-123669673; in Canada, R140496720. Canada Post International Publications Mail Product (Canadian Distribution) Sales Agreement No. 266477.



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COVER STORY



The 12th Annual Awards for Technical Excellence

BY MICHAEL J. MILLER

The PC industry ships thousands of fine products every year. Yet only a handful embody the sort of vision and technical innovation that truly advance the state of the art. It took *PC Magazine's* editors, Labs staff, and writers six weeks of long and often heated debate to find them. Here are the results: 10 winners of *PC Magazine's* prestigious Technical Excellence Award and 20 distinguished finalists. We also honor the people behind the technological breakthroughs that transform the way we use computers.....103



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FEATURES

PCs

PC, COME HOME

BY WILLIAM P. FLANAGAN

The holiday season is once again upon us, and if you're like many people, your shopping list includes a new PC for your home or home office. In this roundup of 32 home PCs, we evaluate all of the elements that make a great home machine, including ease of setup, quality of bundled software, and telephony features. And using our new benchmark tests, PC Labs measures system performance under Windows 95, as well as each home PC's multimedia prowess136



The Gateway P5-75 Family PC.

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Fast Ethernet Adapters

SHIFTING INTO HIGH GEAR

BY JOHN GARRIS

When you add fast PCs running multimedia and client/server applications to your LAN, you soon find yourself wishing for more network bandwidth. Hybrid 10/100 Fast Ethernet cards, priced almost the same as regular Ethernet cards, let you continue using your existing 10-Mbps LAN today and jump to 100 Mbps when you're ready. We test and compare 20 Fast Ethernet network adapters that can grow with your network—and we check on 100VG-AnyLAN, another 100-Mbps networking standard. We also review today's asynchronous transfer mode (ATM) products and discuss where ATM is headed as the networking standard of the twenty-first century201

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PC Magazine At Home: Holiday Gift Guide

101 REASONS TO CELEBRATE

BY GAYLE C. EHRENMANN

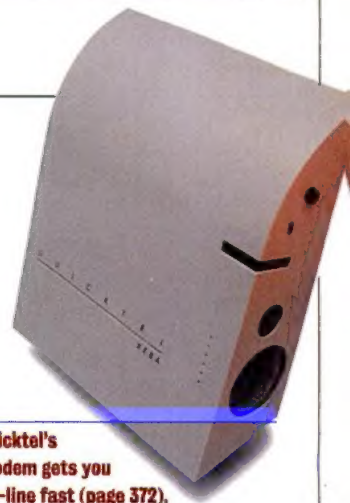
Are you looking for a few gift ideas now that the holidays are upon us? Look no further, because we've gathered 101 of the coolest software products to hit the shelves during 1995, including games, kids' titles, and even some funky gadgets341

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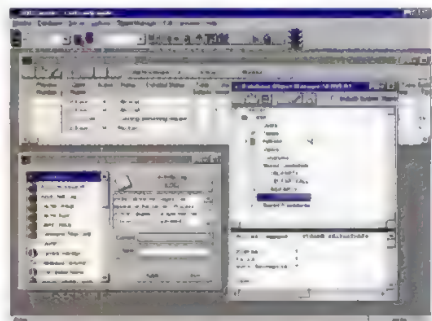
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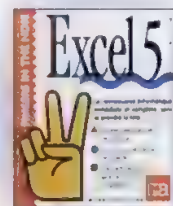
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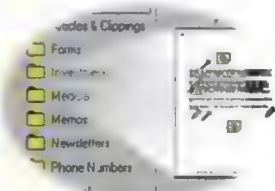
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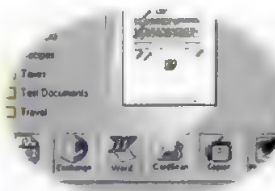
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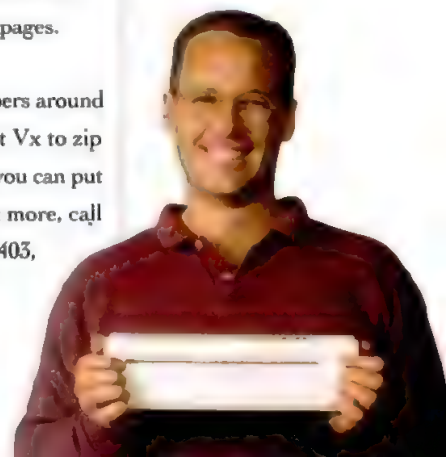
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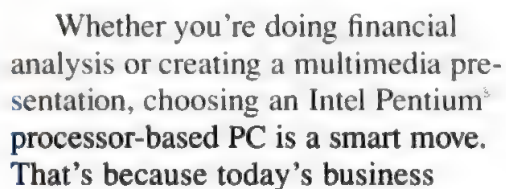
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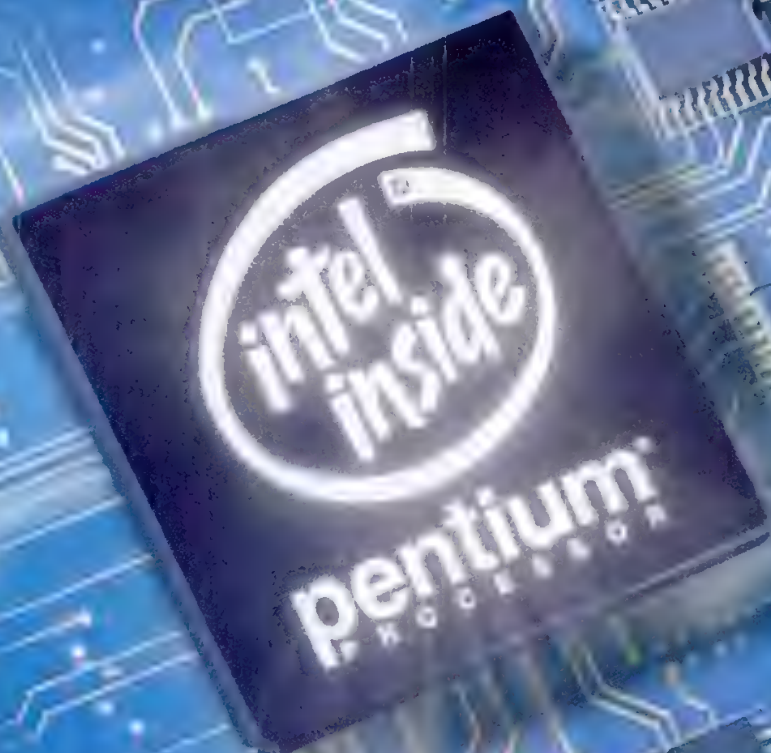
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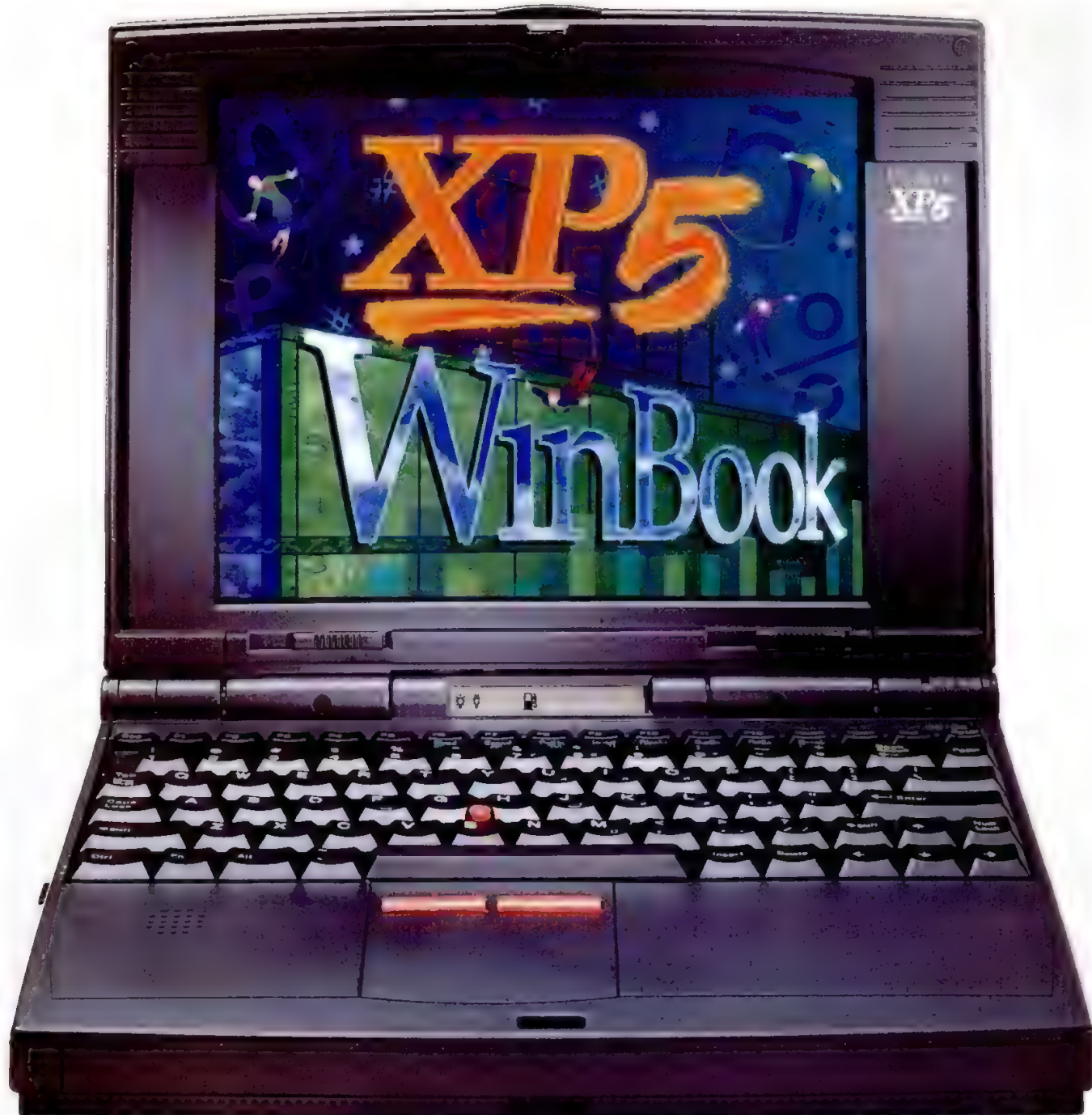
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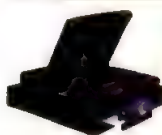
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WM You can even get WinFax PRO as part of new Delrina CommSuite™ 95, the complete, affordable, integrated communications software solution for Windows 95. WM All of which should suffice until the new alpha wave faxing program is ready. (Hmm. Perhaps if we *partition* your brain so that one half can receive faxes while the other remains undisturbed...) **DELIRINA**

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Letters

CABLE MODEMS: GOLD MINE OR FIASCOP

John C. Dvorak thinks cable modems are to be bought and plugged in by individuals who will use these blazingly fast devices with existing communications networks ("The Looming Cable Modem Fiasco," September 12, 1995). Like his many blatant misconceptions about cable modems, the cable industry, and telecommunications in general, this could not be more wrong.

Thanks to the other elements of a cable network, cable modems will not run into a 56-Kbps data wall. Rather, they will pump information at up to 3 Mbps, where the limitation becomes the PC's I/O capability. Dvorak's assertion that there's no reason to use cable instead of ISDN and broadband is dead wrong. Cable is faster by a factor of 100, delivering throughput of up to 5 Mbps. Equipment vendors are not avoiding cable. In fact, Motorola, General Instruments, and Scientific Atlanta, among others, are investing heavily in development for cable. The idea that cable networks do not offer upstream capability or proper security was once true, but is less so today. And each week there's news of investments by cable operators to support two-way traffic.

MIKE SCHWARTZ,
Vice President/Communications,
CableLabs,
Boulder, Colorado

A cable modem uses a cable connection that's already in my house and doesn't require me to convince a Bell representative to come out to my home. I can keep my current setup, whereas with ISDN, I need to buy adapters to use the phones I already own. With cable modems and ISDN adapters finally evening out in price, the only real question regards the per-hour charge. And right now, it seems that cable-modem pricing will be far less than that of ISDN.

MARTIN EICHMAN,
via the Internet

Great comments on the cable modem fiasco. Everyone seems to ignore the costs to companies of upgrading their systems' return path. Sure, some systems are two-way today, designed for addressable converters to order pay-per-view movies. But I've seen estimates of around \$10 to \$100 per home to perform the necessary upgrade to older systems.

BEN HARTMAN,
via PC MagNet

Dvorak shouldn't worry about users not needing the extra speed offered by cable modems; when the bandwidth is there, people will use it. Remember when a 40MB hard disk



ISDN is almost obsolete before it's even achieved broad acceptance.

seemed like more than you'd ever need? The cable companies that survive will be the ones that diversify into data services.

Despite Dvorak's comments, for much of the country ISDN isn't "here now." And speed is the issue; otherwise, we'd all still be perfectly happy with our Hayes Smartmodem 1200s. Speed will become even more of an issue as consumers start expecting services like video-on-demand. There's no guarantee that cable modems will take the country by storm, but if they don't carve a niche in the market, it will be due to bad planning and implementation, not a lack of technical merit.

LAWRENCE RACHMAN,
via PC MagNet

Cable modems are now appearing in my area, southeast Pennsylvania, and offer 500-Kbps access to the Internet. Fast access to the Internet is what home users want most. Imagine cruising the Net at 500 kbps and downloading files in a fraction of the time it takes now. And you can still receive a phone call while you're doing it. Plus, cable modems allow you to stay on the network without per-minute charges. ISDN is almost obsolete before it's even achieved broad acceptance. The fact of the matter is that cable modems are leapfrogging ISDN; they provide higher bandwidth at a lower cost.

GEORGE WARNER,
Lititz, Pennsylvania

I recently decided to jump into the ISDN foray. What I expected to be an absolute nightmare turned out to be exactly the opposite. I called

the local telephone company, asked about ISDN and was immediately transferred to a knowledgeable representative who asked what type of equipment I was planning to use, provided me with line and usage costs, and then scheduled installation for less than a week later. Installation went without a hitch, and voilà! 57.6-Kbps access to the Net. I couldn't be happier. Dvorak is right: ISDN is here now, and it's the best choice for personal access.

GARY RODGERS,
via the Internet

Dvorak is right on about cable TV operators being inadequately equipped. Cable-modem support? Yeah, right. I can't even get Comedy Central.

KEVIN PIERCE,
via the Internet

Dvorak's column about the coming cable modem fiasco is right on the point, except for one thing: The fiasco isn't coming; it's here. Two years ago, Continental Cablevision announced with great hype that it would be offering Internet connections through cable, and it wired up a couple of Macintosh systems at the local public library as a demonstration. Here it is, two years later, and the library remains the only cable-connected site in town. Why? Exactly for the reasons that Dvorak noted: Turning a one-way cable line into a two-way Internet connection is difficult, way beyond what a cable company can handle, and the modems don't really work reliably. I've also had a similar experience with Time Warner Cable.

In the meantime, the telephone companies, which have a century's experience in two-way connections that work, are marching into the Internet business. Sooner or later, the major companies will figure out that they can offer competitively priced Internet service, and they'll blow past the confused cable companies and everyone else.

JOHN R. LEVINE,
Trumansburg, New York

Over the last few years, most of the nation's cable TV networks have been rewiring their systems with fiber-optic cable, the bandwidth and speed of which far exceed anything the telephone companies have managed to come up with so far, including ISDN. Cable would make an ideal data network; indeed, a few cities have experimented successfully with just that. Watch for the telephone companies to buy up the cable companies and then build on what's already been set in motion. I agree with Dvorak that cable modems are "dead-end technology." But speed very definitely is the issue, and ISDN can't provide it (except for rudimentary activities such as Internet surfing and transferring

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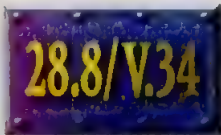
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Letters

files). The future promises much more excitement than that.

ERIK C. STROM,
via the Internet

PORTABLE MULTIMEDIA MANIA

Jim Seymour's impressions about the new breed of multimedia notebooks are right on the mark ("Tucking a Home PC Under Your Arm," September 12, 1995). Speaking as an owner of one of the CD-ROM-equipped Toshiba 2150 laptops, I would never again buy a laptop, or any PC for that matter, without a CD and sound system. Not only can I play my game and music CDs, as Jim points out, but I can also record and play back .WAV files, or access a Photo CD of 50 slides from my kayaking vacation. Software installations off a CD are a joy, too; no more of the "Please install disk 6" nonsense. So much is available on CD-ROM now, including the excellent PC Magazine CD series.

I think that your emphasis on multimedia laptops as business presentation tools in your recent portables roundup ("Your Portable Persona," August 1995) misses the tremendous utility of these machines for everyone. It's much more enjoyable to sit outside with my laptop on an evening here in Vermont, looking out on the Green Mountains, than to sit cooped up in an office. I almost forget I am actually "working."

R. HEIMBECKER,
Montgomery, Vermont

DIFFERENT REASONINGS

Your First Looks review of MagnaRAM ("MagnaRAM Compresses Windows Mem-

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CORRECTIONS AND AMPLIFICATIONS

The First Looks review "QmodemPro Brings Communications into the Win 95 Era" (October 24, 1995) incorrectly stated that the program dropped characters.

In "MGA Millenium Speeds Up Graphics with Windows RAM" (First Looks, October 19, 1995), the price of the MGA Millennium was reported incorrectly. The correct list price is \$549 for the 4MB version. In addition, the article stated that the Millennium received the second-highest score for a 4MB board on our Winstone 95 benchmark tests at 1,024-by-768 resolution with 16.7 million colors. But subsequent inspection showed slight differences among our test-bed systems, and retests showed that the Matrox board received the highest score among all the 4MB boards tested.

Finally, although the article stated that "3-D acceleration is supported only at 640-by-480 resolution with 16.7 million colors and at 800-by-600 with 65,536 colors," the board can actually display 3-D images at higher resolutions with fewer colors.

ory—"But Do You Want It To?" September 26) misses the point. From the start, the review fails to understand why many people are considering RAM-compression routines. There are a lot of 4MB machines out there. The average user is far more comfortable installing software than hardware, and buying software such as MagnaRAM is cheaper than buying 4MB of RAM. It may be that RAM compression will not make a 4MB machine suitable for running Windows 95, which is why many folks want a faster machine in the first place. This point was not addressed in the review.

HAL DAVIS,
via the Internet

ALMOST, BUT NOT QUITE

Jake Kirchner's Pipeline column, "Buddy, Can You Spare a Megabyte?" (September 26, 1995), is potentially confusing. The column makes it sound as though Panasonic's PowerDrive² is a CD-R drive, when that's not the case at all. Instead, Panasonic just happens to have combined two technologies in one case. It's not much more than the dual-media floppy disks.

GEORGES BROWN,
via the Internet

ANOTHER PERSPECTIVE

Thanks to Bill Machrone for his column "Disabling Technology" (September 26, 1995). It is all too easy to forget about those who suffer from handicaps. Considering the fact that the computer age is in its infancy and computers are constantly becoming more and more powerful, it's time that we—as an industry—concentrate more on making computers accessible and usable to those with disabilities.

STEVEN ENGELBRECHT,
via the Internet

Machrone's column raises an important issue, but misses one major point. I am a volunteer reader for a blind couple with a PC. Just as the advent of text-to-speech software and voice control has opened the door to PCs for the blind, the growing popularity of graphics-only software is slamming the door

shut again. Consider that if you couldn't see those pretty windows, you couldn't run your computer. The blind are limited to DOS-only software, because text-to-speech software can't read, or translate, Windows. But DOS is dying. And in just a few years, as Windows 95 crowds out DOS once and for all, the segment of the population that can't see a graphical user interface won't have any interface at all. What we really need is a text-to-speech program that can navigate Windows, so that the blind aren't excluded from the wild ride that is the computer industry.

AL VERRIER,
via the Internet

A LOVE-HATE AFFAIR

I can't resist responding to Bill Machrone's Second Looks observations on WordPerfect 6.1 for Windows (September 26, 1995). I agree with both sides of the issue. I am by turns the person happily merging, formatting, and drawing, and the one hitting Ctrl-Alt-Delete. I'm a loyal WordPerfect user, but, from my vantage point as the employee of a large university, I can see how WordPerfect's—now Novell's—situation is tragic. While Microsoft lures educational institutions with discounts and package deals, and thereby causes schools to stop supporting WordPerfect, Novell drops its technical-support 800 line for WordPerfect.

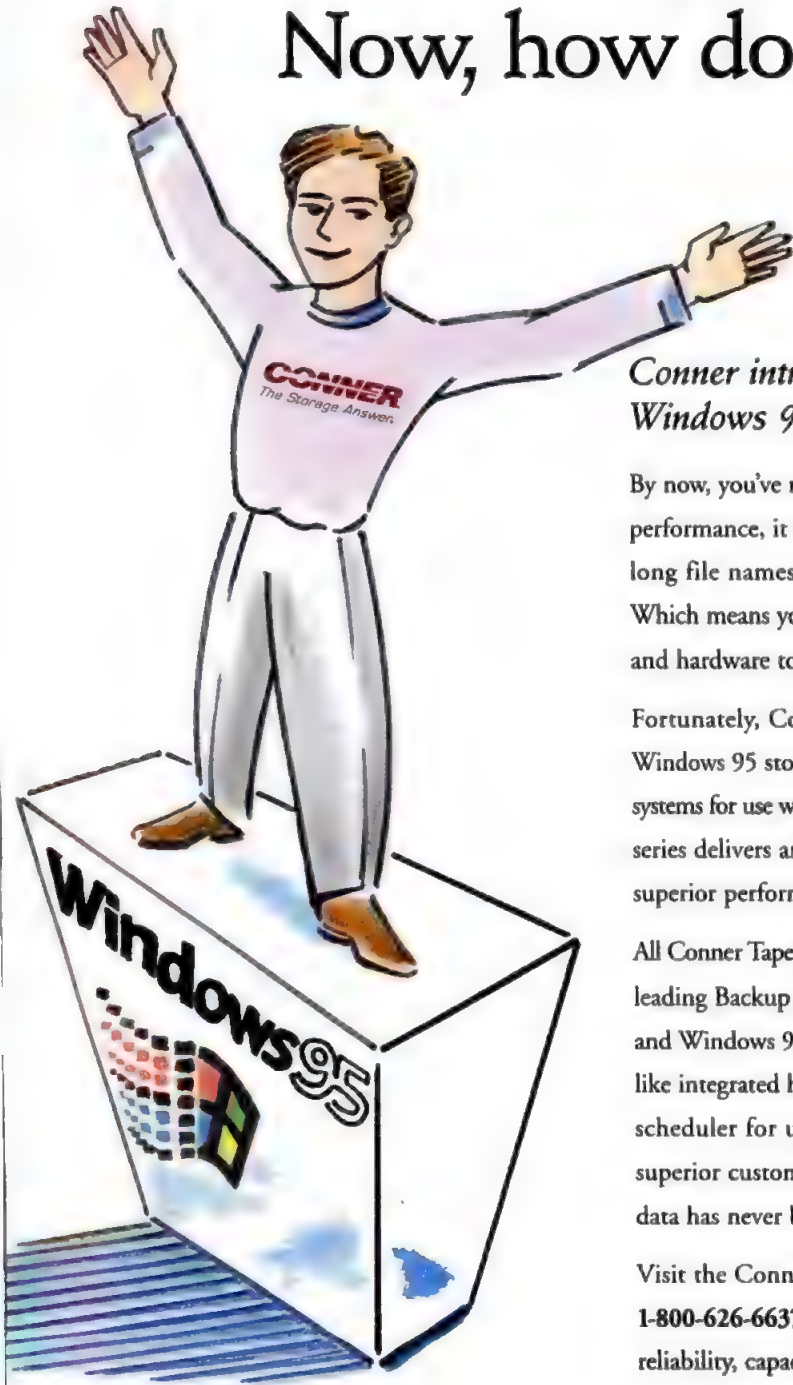
RICK EXNER,
via the Internet

AN EVEN COMPARISON

Thanks for your roundup of 17-inch monitors ("Bigger Windows," September 12, 1995). As usual, your reviews were detailed and informative. But while you included a number of different products, it would have been useful to know how these monitors stack up against those that ship with packaged systems from such popular vendors as Gateway, Dell, and Compaq. Without that kind of comparison, it's difficult to evaluate a system for purchase, since most systems are sold with a monitor.

DAVID G. MARTIN,
via PC MagNet

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While each Meridian product is distinct, they all have several intelligent features that set them apart. All include local bus video; an 84-key keyboard with a comfortable palm rest and integrated TruePoint™ pointing device; and the most solid construction available.

Meridian 400 Subnotebook



"ZEOS is out to prove that good things do come in small packages with its Meridian 400C subnotebook," reported *Windows Magazine*.

At 3.9 pounds, the Meridian 400 is molded with a special carbon-fiber material that cuts weight and improves durability. And with a DX4-100MHz processor *standard*, it may well be the highest performance subnotebook available; "faster than a speeding desktop" is how *Computer Shopper* described it.

In addition to great performance, you also get hard drives to 350MB, RAM that's user upgradable to 20MB, two Type II PCMCIA slots, an external ultra-light 3.5" 1.44MB floppy drive (included in Packages 2 and 3) and your choice of active matrix or dual scan color screens. Amazing!

Meridian 800 Notebook



"The 800C notebook offers sleek styling, solid construction and hot performance.... one of the fastest notebooks we've ever tested," said *Windows Magazine*.

At 6.3 pounds, the Meridian 800 full-size notebook is light enough to travel anywhere yet, with its whopping 10.3" dual scan or 9.5" active matrix color display, is large enough to use for presentations and everyday computing.

To complete the package, you also get a DX4-100MHz CPU, up to 20MB of user-upgradable RAM, a removable hard drive to 528MB, a built-in 3.5" 1.44MB floppy drive and PCMCIA slots supporting two Type II or one Type III devices. Full desktop features that fit in your briefcase!

Meridian 850 Notebook

"On our Graphics Winmark 95 tests... ZEOS's Meridian 850C grabbed the top position. The ZEOS 850C again finished first on our Disk Winmark 95 tests," reported *PC Magazine*.

Imagine, today's most advance computing capabilities wrapped up in a 6.8 pound package. With features including your choice of Pentium® processors, a 256K synchronous SRAM cache, user-upgradable memory to 32MB, removable hard drives to 1.3GB, PCMCIA support for two Type II or one Type III devices

and a built-in 3.5" 1.44MB floppy drive, this is the notebook computer that rivals today's most advanced desktops!

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No matter which Meridian notebook you purchase, you get the best service

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With the ZEOS Meridian notebooks, you can go anywhere and be productive. Their performance, quality, reliability and durability make them a first-class travel companion. And it's easy for you to get on board. Just call your ZEOS Systems Consultant for a tour now at 800-554-7172. You won't want to miss it!

Package 1			Package 2			Package 3		
	400C	800C		400C	800C		400C	800C
DX4-100	\$1695	\$2295	DX4-100	\$1995	\$2495	DX4-100	CNI \$2295	CNI \$2795
▶ 4MB RAM ▶ 260MB IDE hard drive ▶ 800: Internal 3.5" 1.44MB floppy drive ▶ MS-DOS 6.2 & Windows for Workgroups 3.11 ▶ MS Works			▶ 8MB RAM ▶ 350MB IDE hard drive ▶ 3.5" 1.44MB floppy drive. 400: External, 800: Internal ▶ Custom nylon carrying case ▶ MS Windows® 95 or MS-DOS 6.2 & Windows for Workgroups 3.11 ▶ MS Works 95 or MS Works			▶ 8MB RAM ▶ IDE hard drive. 400: 350MB, 800: 528MB ▶ 3.5" 1.44MB floppy drive. 400: External, 800: Internal ▶ 14.4 PCMCIA fax/modem ▶ Custom carrying case. 400: Leather, 800: Nylon ▶ Extra battery ▶ MS Windows 95 or MS-DOS 6.2 & Windows for Workgroups 3.11 ▶ MS Works 95 or MS Works		
Pentium® Processor	850C		Pentium® Processor	850C		Pentium® Processor	850C	
75MHz	\$3095		75MHz	\$3595		75MHz	\$3995	
90MHz	\$3295		90MHz	\$3795		90MHz	CNI \$4195	
▶ 8MB RAM, 256K synchronous SRAM cache ▶ 528MB IDE hard drive ▶ Internal 3.5" 1.44MB floppy drive ▶ Integrated 16-bit stereo sound ▶ MS Windows 95 or MS-DOS 6.2 & Windows for Workgroups 3.11 ▶ MS Works 95 or MS Works			▶ 16MB RAM, 256K synchronous SRAM cache ▶ 810MB IDE hard drive ▶ Internal 3.5" 1.44MB floppy drive ▶ Integrated 16-bit stereo sound ▶ Custom nylon carrying case ▶ Extra battery ▶ MS Windows 95 or MS-DOS 6.2 & Windows for Workgroups 3.11 ▶ MS Office Pro 95, or MS Office Pro			▶ 16MB RAM, 256K synchronous SRAM cache ▶ 1.3GB IDE hard drive ▶ Internal 3.5" 1.44MB floppy drive ▶ Integrated 16-bit stereo sound ▶ External amplified speakers ▶ 28.8 PCMCIA fax/modem ▶ Custom nylon carrying case ▶ Extra battery ▶ MS Windows 95 or MS-DOS 6.2 & Windows for Workgroups 3.11 ▶ MS Office Pro 95, or MS Office Pro		

Prices shown include dual scan color display.

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- ▶ IDE upgradable HDD. 400: to 350MB, 800: to 528MB, 850: to **1.3GB**.
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- ▶ Supports an external SVGA color monitor at resolutions up to 1024 x 768.
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- ▶ Ports: Serial, parallel (850: enhanced EPP & ECP), external SVGA video, external keyboard or PS/2 mouse (800 & 850 both). 400 also with external floppy drive. 850 also with mic-in and stereo speaker-out.
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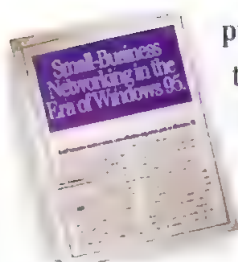


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Trends

TRENDS & TECHNOLOGY SHAPING THE PERSONAL COMPUTER MARKET

The Digital Curator

Bill Gates expands electronic art collection.

Slowly but surely, Bill Gates is accumulating the largest collection of art and images ever. Through a small Seattle company that Gates owns, called Corbis, he's spending big bucks to control the electronic

rights to the world's most famous images. The company's most recent purchase was the Bettmann Archive of more than 16 million film and digital images, for which Corbis paid the Kraus Corporation \$25 million.

The purchase exponentially increases the amount of content that Corbis controls, including the electronic rights to images in the David Meunch collection, the Library of Congress, the National Gallery of London, the Philadelphia Academy of Natural Sciences, the Philadelphia Museum of Art,

source at the San Francisco Museum of Art, "For Gates or any individual to own the electronic rights to the world's art could result in abuse of that power." Corbis's business strategies include publishing via CD-ROM as well as pay-per-image on-line distribution.

Is Corbis an attempt at super control over images that many feel should remain as accessible as possible to the public? Our source at the San Francisco Museum of Art did note that after Gates purchased the Da Vinci man-



For a tour of Corbis' on-line gallery, including photographs from the recent Bettmann Archive purchase, visit the Corbis Web site at <http://www.corbis.com>. Virtual-reality tours are next.

the Richard Hamilton Smith collection, Roger Ressmeyer's collection, and the Sakamoto Archive. Last year Gates paid over \$30 million for an illustrated Leonardo Da Vinci manuscript.

By some estimates, Corbis will own the rights to the vast majority of all the digital images in the world by the turn of the century. This prospect is the source of hot debate in the art world. According to a

uscript, he turned around and loaned it to museums around the world.

Still, there's no competitor in site, and there's no mistaking the potential value of the control that Corbis is accumulating. Corbis officials point out that the company's name comes from the Latin for woven basket, "the most ancient and universal kind of vessel for storing valuable possessions."—*Sebastian Rupley*

Mobile Memory

A DOZEN COMPANIES FROM THE computing, imaging, communications, and consumer electronics industries have joined hands to form the CompactFlash Association

to promote a single-removable storage device. CompactFlash (CF) technology lets you easily transfer all types of digital information—data, audio, and images—among computers, cameras, cellular phones, video cameras, and other gadgets.

SanDisk has big plans for its tiny chip set.

Developed by SanDisk (formerly SunDisk) and introduced over a year ago, the CF cartridge is compact, rugged, low-powered, and removable—about the size of a matchbook or one-fourth the size of a PCMCIA card. CF cartridges today are available in 2, 4, 10, and 15MB capacities.

At those capacities, though, this new media has room for growth. "Within three years, the 256MB technology that SanDisk has announced with NEC will provide 100MB CompactFlash. We can expect to see that hit 500MB at the turn of the millennium," says Jerry Purdy, editor of *Mobile Letter*. "Since most of the consumer electronics companies in the world are committing to using CF for solid state storage, I can't believe anybody else would come out with a small form-factor storage design," says Purdy.

SanDisk recently introduced its smallest flash chip set, which it's selling to makers of palmtop computers, cellular phones, audio recorders, and digital cameras. It also has a cross-license agreement with Intel, which enables Intel to manufacture CF silicon.

Members include Apple Computer, Canon, Eastman Kodak, Hewlett-Packard, LG Semicon, Matsushita, Motorola, NEC, Polaroid, SanDisk, Seagate Technology, and Seiko Epson. Many of them are now designing CF technology into next-generation products. The first product with built-in CF is the IBM Palm Top PC 110 introduced in September in Japan.—*Carol Levin*

Pipeline *By Jake Kirchner*

Searching Outside the Box

To work at *PC Magazine* is to be surrounded with technology junkies. These are people who will ooh and aah for days over a new-fangled pointing device on the latest notebook computer just arrived in our lab. People for whom the arrival of the first Pentium Pro desktop ranks only slightly below a papal visit in terms of excitement. And the rapture that ripples through the cubicles over the latest computer flight simulation, action game, or O.J. avatar on the Web—don't get me started!

In short, the atmosphere here is exhilarating, energizing, and spanking-good fun. Although in the interest of staff-wide job security I'm obliged to add that one heck of a lot of hard work is done here, the truth is that you practically have to send in a SWAT team to get most of us to go home at night.

With that in mind, you'll understand why fall is such a special time at *PC Magazine*. At this time of the year we get to indulge ourselves in our two most favorite pastimes—testing products and arguing about them—as we pick our annual Technical Excellence awards and select our best products of the year. You can read about the Tech Ex selections in this issue. The “Best Of” selections roll out in the next issue.

At times like this, I usually remind myself that just because you see a lot of trees around you doesn't mean you're in the middle of a forest. Despite all of its dazzling technical complexity and rapid innovation, the personal computing world is actually a pretty simple place. You have a box of software and data on your desk, connections to other boxes of software and data, and some reason—typically needed functionality or

desired content—to have the first two.

By my reckoning, over the last 20 years there have been three broad waves of innovation in hardware, software, and content that together have produced today's world of personal computing:

1. The personal computer and personal productivity software, which took personal computing from the hobbyist realm and put it into the hands of anyone who needs or wants it.
2. Connectivity, particularly through local-area networks, which made it possible for anyone to be connected to anyone else.
3. The development of World-Wide Web browsers, which brought the Internet to the masses and gave everyone a reason to have a personal computer and be connected in the first place.

Every invention or innovation in our industry the last 20 years has been a variation on one of those themes. The ones we get really excited about are the ones that appear to fall outside that three-way structure or to cut across several of them. A recent example is the BeBox from Be Inc. Hailed widely as a stunning technological innovation, the BeBox is a souped-up, dual-processor PC running a proprietary operating system and optimized for graphics and communications. Its innovation appears to cut across all three areas of development. On the other hand, it may just be an extremely interesting new way of building a box of software.

So does the BeBox define a fourth dimension of basic innovation, or is it just another Newton? The fun part is that it's too early to tell. Technophiles to the end, we will no doubt wax very enthusiastic over the BeBox once we get hold of one.

Keep in mind that all three basic developments of personal computing—the PC, the LAN, and the Internet—once were outside the box of computing concepts and capabilities. The innovations we find outside the box are the ones to get really excited about, because they have at least the potential to revolutionize our lives. I'll let you know next time we come across one.

Jake Kirchner is the editor of PC Magazine.



Faster Multimedia

JUDGING FROM THE BUZZ AT THIS year's Microprocessor Forum, a new generation of digital signal processors (DSPs) is poised to boost the multimedia accelerator market. Led by startups and industry giants alike, manufacturers have their sights set on accelerating tasks ranging from video telephony to games to digital television.

Much of the fanfare at the conference surrounded new accelerators based on Very Long Instruction Word (VLIW) technology from Trimedia (a unit of Philips), IBM, and the Silicon Valley startup, Chromatic Research. VLIW consists of multiple execution units running in parallel that perform multiple instructions during a single clock cycle. It calls for instruction “packing” and scheduling to be done via a compiler, in advance of run-time, the more time-consuming fashion in which superscalar chips

such as the Pentium work. VLIW is the core technology behind IBM's Mfast and Chromatic Research's Mpack multimedia chip.

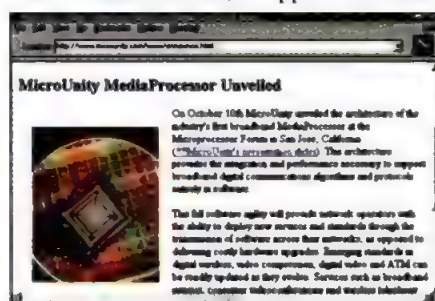
Another Silicon Valley startup, MicroUnity, made a splash at the Microprocessor Forum by unveiling its Broadband Multimedia Processor. According to MicroUnity's Tony Stellega, this is the first media processor that truly supports broadband rates, enabling you to, say, connect a broadband link to a PC from a cable network, as opposed to a nar-

rowband link from a phone network.

MicroUnity's CEO John Moussouris, who founded the processor-maker MIPS, says its proprietary production process allows it to pack three times as many transistors on a chip as the same-size Intel Pentium. After seven years of secret work on the chip, Moussouris is broadly licensing the architecture. The company is said to have significant investments from Microsoft, Motorola, TCI, and Time Warner.

A healthy environment for makers of alternative processors is exactly the opposite of what some had predicted earlier this year when Intel pushed its native signal processing (NSP) effort. NSP, which aimed to off-load functions handled by dedicated processors onto the main CPU, was seen by many as a threat to DSPs. Intel is repositioning NSP after tepid support from the hardware community, leaving the door open wider for a new generation of dedicated processors.

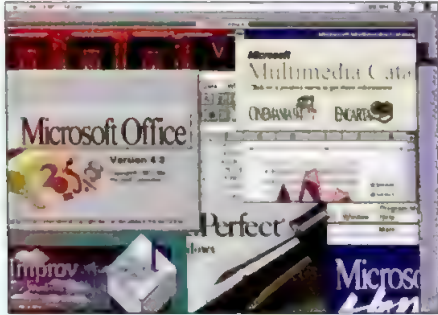
—*Sebastian Rupley*



MicroUnity's media chip has broadband speeds.

If You Can't Beat Them, Emulate Them

FROM INDUSTRY POWERHOUSE IBM to small software shop Insignia Solutions, technologies designed to marry computing on other platforms with computing on Microsoft's operating systems are gathering momentum. Emulation is the key enabling technology for many of these solutions, and while previous emulators have been written off as slow and clunky,



Insignia's SoftWindows 2.0 lets PowerMac users run Windows and Macintosh apps concurrently.

faster CPUs, digital signal processors (DSPs), and better emulation software are improving credibility.

PC Magazine recently completed First Looks coverage of Insignia Solutions' new SoftWindows 2.0 software for running DOS and Windows applications on the Power Macintosh platform (see First Looks, November 21, 1995). SoftWindows 2.0 benchmark tests on a PowerMacintosh 9500 system from Apple showed DOS and Windows applications running at speeds comparable with those on a 25-MHz 486 system—a quantum leap over previous generations of the software. That will hardly stir performance hounds, but it will eliminate the intolerably long waits typical of previous releases.

Leigh Dworkin, SoftWindows' product manager, says SoftWindows is "aimed at users spending less than 30 percent of their time in Windows applications." According to Dworkin, "There's a big market for people who want to stick with RISC architecture and gain some access—but not exclusive access—to Windows applications."

New CPUs and DSPs may be poised to brighten the future for emulation. Insignia Solutions' Dworkin says speeding up graphics is a key challenge for emulators, especially as graphical interfaces become more elaborate. "We're looking carefully at several of the DSP solutions announced at the recent Microprocessor Forum, especially some of the new VLIW (Very Long

Instruction Word) chips. We see them as opportunities for emulators like ours to address much more of the x86 instruction set and become much faster."

IBM's new Mfast media processor was one of the new VLIW chips announced at that conference. IBM is also focused on on-board emulation of the x86 instruction set on PowerPC chips themselves. While IBM scrapped plans to construct a Power PC 615 processor that would rely solely on firmware in the RISC chip to provide Windows programs with Intel's 486 in-

struction set, the new PowerPC 604e does incorporate hardware and software solutions for emulating DOS and Windows. Insignia Solutions' Dworkin also sees a future for marrying SoftWindows' technology with other CPU offerings such as IBM's.

Of course, emulation is inevitably a compromise. As Insignia Solution's Joanne Hartzell points out, "The more x86 instruction emulation you build into a RISC chip, the less RISC it is." Still, as Intel and Microsoft continue to gain dominance at the expense of alternative platforms such as Apple's, emulation is becoming a more viable—albeit slow—peacemaker.—*Sebastian Rupley*

The Searchers

THE INTERNET HAS NOT YET found its Melvil Dewey. Until it garners a solid method of classification in the vein of Dewey's eponymous decimal system, the World-Wide Web must rely heavily on search tools whose result sets are often unwieldy and seldom annotated. If you search on a keyword with the popular WebCrawler, for instance, identifying useful sites within its list of cryptic names and URLs is usually a time-intensive task. The advent of several new engines, however, has enhanced the search tool idiom.

Architext Software's Excite Web page (<http://www.excite.com>) serves up four useful sites via a tabbed-pages metaphor. Although the first tab, NetSearch, resembles the WebCrawler interface, it produces vastly different result sets that are much easier to manage. Since each site is identified with a descriptive name and accompanied by a lengthy summary, you can easily weed out unwanted sites. Furthermore, Architext lists sites according to the estimated accuracy of their keyword matches. Excite also offers site reviews, which go a step beyond Yahoo (<http://yahoo.com>); it not only organizes sites into categories, but also provides a terse critique for each of them.

Like Excite, the new JumpCity site (<http://www.jumpcity.com>) provides annotated results, a categorized collection of site reviews, and a news section, but it also adds a few novel features. Each reviewed site has a four-digit

jump code, which lets you to access the site without typing in a URL or leap to its JumpCity critique. This page also offers information on JumpCity's print publications, which have consolidated jump code lists.

The OpenText site (<http://www.opentext.com>) does not offer reviews, but it does have two advanced search methods. The OpenText Simple Search is supplemented by Power Search and Weighted Search. Not only does the Power Search allow you to seek keywords in titles, summaries, headings, or URLs, but it also lets you supplement a keyword with limited criteria. The Weighted



JumpCity offers site critiques and jump codes for quick access.

Search lets you specify identical criteria as well as weight keywords with an integer value.

Two other sites, Magellan (<http://www.mckinley.com>), from the McKinley Group, and Global Network Navigator (<http://www.gnn.com/wr>), from O'Reilly and Associates, are hard to access during standard business hours, but each offers reviews and ratings.

Yahoo and WebCrawler may be the staples of Web searching, but these alternatives are as useful if not more so. They should satisfy your Web yens as you wait for a consolidated net directory.—*Cade Metz*

Americans Reveal On-line Habits

AMAZING WHAT A DIFFERENCE A year makes. Last year, the Times Mirror Center for the People & the Press examined how American households use technology and found that computers were moving into homes at a fast clip. The second annual study brings things into much clearer focus.

Based on phone interviews with over 4,000 adults and teenagers, this year's survey highlights the exponential growth of the World-Wide Web and on-line services. It also examines purchase patterns and provides a picture of consumer computing in 1995.

Some conclusions:

- The number of Americans subscribing to an on-line service jumped from 5 million in the fourth quarter of 1994 to nearly 12 million by mid-1995. Two million people bypass commercial on-line services altogether and connect directly to the Internet.
- More users are "very satisfied" with their direct Internet service provider than with the Big Three on-line services.
- Half of the public fears an invasion of privacy and that Big Brother, in the form of

computers, will be watching over them to some degree.

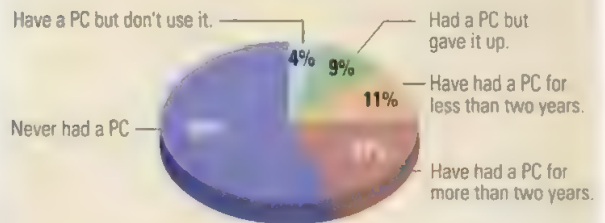
- Of Web users, 40 percent revisit their favorite sites, while only 17 percent head to new sites.
- Only 8 percent of respondents had ever heard of the Web. That number jumps to 60 percent among on-line users. Yet only one-third of those on-line users have gone onto the Web.
- Almost twice as many men go on-line as women.
- Of PC users, 48 percent have a CD-ROM drive.
- Of PC users, 63 percent said they would miss their home PCs "a lot"; that segment beats out newspapers and is nearly 10 percent higher than those who would miss their cable TV.
- The new wave of computer owners is younger. 18- to 29-year-olds make up one-

third of those respondents who have acquired computers in the last two years, compared with one-quarter of those who have had a computer in their homes for over two years.

- Of households, 55 percent have never had a computer; the 4 percent who have a computer do not use it.
- Finally, there is some leveling off by gen-

Computerless Homes

The number of U.S. households with PCs increased from 31 percent in February 1994 to 36 percent in June 1995. Still, almost two-thirds of households do not have PCs.



Source: Times Mirror Center for the People & the Press

der. 51 percent of males and 49 percent of females responding have acquired a computer in the last two years.

—Melissa J. Perenson

Top Retail Software

Current ranking	Last issue	Product/company
1	2	SoftRAM 95 Synchronys Software
2	—	Netscape Navigator Ventana Media
3	—	WordPerfect 6.1 Novell Inc.
4	—	Simply 3D Superpack 1.0 Visual Software
5	—	Groupwise 4.1 Upgrade Novell Inc.
6	3	MS Plus! for Windows 95 1.0 Microsoft Corp.
7	—	Groupwise 4.1 Novell Inc.
8	8	VirusScan for Windows 95 McAfee Associates
9	—	Drafix Quick CAD 3.01 Softdesk Retail Products Group
10	4	ProComm Plus 2.11 DataStorm

This list ranks PC business programs according to the total number of copies shipped to over 12,000 stores and resellers in the week ending October 13, 1995; the list cannot be interpreted as a picture of the entire software market. Adapted from a compilation by Ingram Micro.

The Home Office Agenda

THE EXODUS FROM THE CORPORATE office that downsizing brings can be thought of as the abandonment of a company's most valuable resource or as the freeing of people for more productive endeavors. One thing is for sure, many people who have abandoned the corporate lifestyle have set up offices in the nooks and crannies of their homes. A recent survey conducted by the Gallup Organization and paid for by Syquest Technology shows that most people are building their home offices around the computer.

Of the more than 1,000 home bodies that Gallup surveyed, 85 percent said that working at home was a full-time job. And with most of them performing a variety of tasks from receptionist to writer to designer, the PC is critical. While most businesses own only one computer, one in eight own three or more.

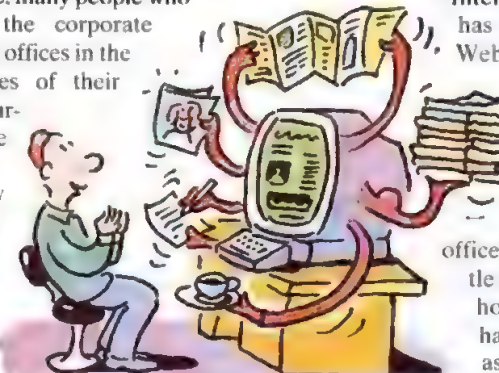
While networking is not a major concern for those surveyed (14 percent have a home office LAN), the Internet is rapidly becoming one. Currently, about one-third of those surveyed had access to the Internet. Among

Internet users, one in ten has a home page on the Web. About four in ten plan to use their PCs to order products on-line.

Often operating on shoestring budgets, home offices need to make a little go a long way. Most home office owners have kept to the basics as far as peripherals go; the most popular peripherals are printers

and modems. The survey also spotlights a curious dichotomy among home office owners. Though the majority of those polled have upgraded their system to meet the needs of their businesses, only a handful plan to buy a new system any time soon.

—Brian Nadel





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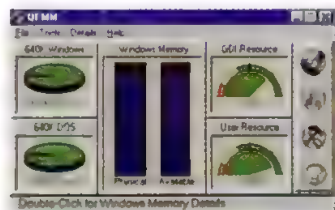
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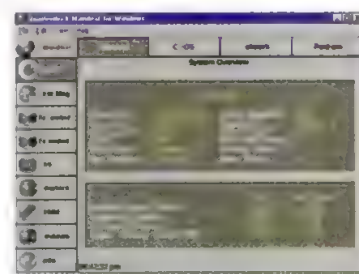


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First Looks

HANDS-ON REVIEWS OF NEW SHIPPING PRODUCTS

NOTEBOOK PCs

A 120-MHz Notebook Quartet: When Speed Is of the Essence

Desktop and notebook PCs continue their lockstep march toward faster and more capable processors and the result is a new generation of higher-performing portable PCs. While desktop systems are about to break the 150-MHz barrier, notebooks are following close behind at 120 MHz. Not only are today's newest and fastest notebooks approaching the performance potential of desktop PCs, they're starting to match them feature for feature.

Key to this upward march is Intel's 120-MHz Pentium CPU, which extends the performance envelope for mobile professionals, but not at the expense of battery life. Built on a 0.35-micron semiconductor process, this chip is a power miser. It features split-voltage technology that operates the I/O at 3.3 volts and the CPU's computational core at 2.9 volts.

The result is that, under typical conditions, the CPU will draw about 3 watts of power, which

drops to less than 1 watt when the CPU is idle. The first four examples of 120-MHz notebooks—Dell's Latitude XPi P120ST, Gateway's Solo S120, Hewlett-Packard's OmniBook 5000 CTS, and Toshiba's Tecra 700 CT—present different ideas about how to squeeze maximum power out of a system that runs on batteries that are smaller than a VHS videotape.

On our tests, we found that these systems advance the state of the art for notebooks, with record



ON THE ROAD: The Latitude XPi P120ST's Super VGA screen and long-lasting battery make the system good on the go.

benchmark test scores across the board, but with battery life similar to that of 90-MHz Pentium sys-

tems. It's as if the extra computational power comes for free. For example, the Tecra 700CT lasted half an hour longer than our reference platform, a high-end Pentium/90-based IBM ThinkPad 760 CD notebook, between charges and outscored the ThinkPad on almost every benchmark test. If all-out computational power is what you crave

in a notebook, the OmniBook 5000 led the pack on all performance indicators but fell short in terms of battery life.

DISK JOCKEYS

This group also represents a wide selection of desktop features: The Solo S120 and the Tecra 700CT include CD-ROM drives, although only the Tecra 700CT of-

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DATABASES

Microsoft Access 95 Innovates As It Integrates with Windows 95

By Sal Ricciardi

Access, Microsoft's database management system, continues to be an excellent choice for a variety of database users from standalone installations all the way to client-server operations. The latest release, Microsoft Access for Windows 95, has a street price of \$339 and improves OLE support, adds a raft of new hand-holding wizards, and introduces a few new features, including database replication. This release makes a good product even better.

In addition to supporting Windows 95's visual conventions, Access 95 supports features such as long filenames, tabbed dialog boxes, and shortcuts. For example, you can create a shortcut to any database object by dragging and dropping it onto the desktop.

Microsoft took this opportunity to create synergy between Access 95 and Windows 95 tools. The database container now

functions as the Database Explorer, which is a handy repository for all of your tables, queries, forms, reports, macros, and modules.

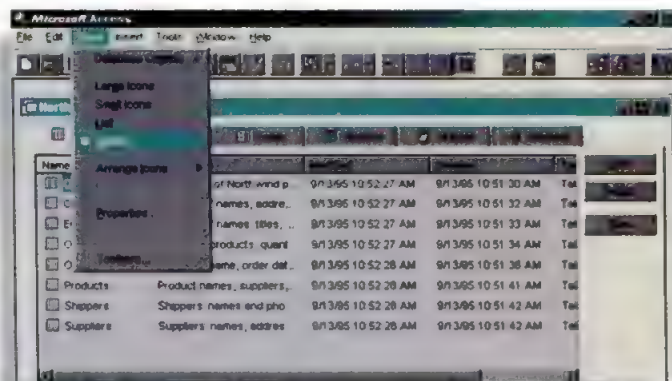
Because Access 95 is included in the Professional Edition of Microsoft Office for Windows 95, it shares common dialog boxes and adopts Office 95's menus and toolbars. Several features have migrated from Microsoft Word: spell-

checking, AutoCorrect, AutoFormat, and the Format Painter, which lets you copy formatting characteristics from one control to another on forms and reports.

Previous Access releases broke new ground by bringing industrial-strength features such as updatable views and declarative data integrity to desktop databases. Access 95 continues to do so with Replication, a feature previously found only in server databases.

Replication is part of Access 95's underlying 32-bit Jet Database Engine, Version 3.0. Using the Win-

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EXPLORE YOUR DATA: Access 95's Database Explorer organizes all of your tables, queries, forms, reports, macros, and modules into one screen.

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First Looks

Pentium/120 Notebooks

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fers a fully up-to-date quad-speed model, while the Solo S120 uses a double-speed unit. The OmniBook 5000 gets by with sound alone, while the Latitude XPi was the quiet one of the bunch without a CD-ROM drive or a sound system. All four systems used color active-matrix displays that were at least 10.4 inches, measured diagonally, and were able to show a variety of resolutions. The Tecra 700CT set the pace with an 11.3-inch screen.

Regardless, this group of notebook overachievers, all of which were running Windows 95, provides a good mix of stellar performance, high-end features, and solid design.

The trouble for many users will be how to choose among them.

DELL LATITUDE XPi P120ST

If you're more concerned with getting a well-designed and manufactured notebook than with its blinding speed or multimedia features, the \$5,099 Dell Latitude XPi P120ST is a solid choice. This is a no-nonsense system that's well suited for communications, writing documents, and crunching numbers.

The unit has a travel weight of 7 pounds 1 ounce and comes in the smallest case of the four systems reviewed here, at 2 by 10.9 by 8.5 inches. But the Latitude XPi doesn't contain as many high-end features as the other three systems in this mini-roundup.

Our test system came with a 120-MHz Pentium processor, 16MB of RAM, a 1.2GB hard disk, and 256K of external cache. Its PCI-based graphics bus uses a Cirrus Logic CL-GD7543 chip set with 1MB of DRAM.

By today's standards, the most obvious omission is sound, which makes the Latitude XPi a poor candidate as a desktop replacement. But on the road, the Latitude XPi's sharp and clear Super VGA 10.4-inch active-matrix screen and its lithium ion battery's 2-hour-22-minute battery life (as rated on our WinDrain test) combine to make the Latitude XPi a

great traveling companion.

Like its predecessors, this Latitude XPi's recessed keyboard includes dedicated cursor keys and a center-mounted trackball. The unit can also accommodate one Type III PC Card or two Type II cards.



DESKTOP LITE: The Solo S120 fits CD-ROM and floppy disk drives, a large display, and 16-bit sound into a small package.

Despite its inclusion of 256K of external processor cache, the 120-MHz Latitude XPi performed slightly below the OmniBook 5000, the Solo S120, and the Tecra 700CT on our Winstone 96, Graphics WinMark 96, Disk WinMark 96, and CPUmark₁₆ and CPUmark₃₂ tests. Its scores were only marginally ahead of those generated by our reference platform, the Pentium/90-based ThinkPad. The Latitude XPi made up for its lackluster performance with an exceptional battery life.

The Latitude XPi P120ST

won't amaze you with cutting-edge features, but its strong battery life and light weight won't disappoint you either. It's a blue-collar system for the corporate user on the go.—William P. Flanagan

Dell Latitude XPi P120ST. List price: With Pentium/120 CPU, 256K external cache, 16MB RAM, 1.2GB hard disk, 10.4-inch active-matrix display, \$5,099. Dell Computer Corp., Austin, TX; 800-289-1460, 512-338-4400; fax, 800-727-8320.

Circle 496 on reader service card

GATEWAY SOLO S120

By leaving very little to be desired, Gateway 2000 has managed to bridge the gap further between high-end notebooks and desktop PCs. The \$5,999 Solo S120 we looked at includes just about everything one could reasonably expect from a well-rounded desktop PC. The only major difference is that the Solo S120 fits into a briefcase.

Gateway targets the Solo S120 at people who need a full-blown computer in a notebook, and it's right on target. The Solo S120 we tested came packed with a 120-MHz Pentium processor, 16MB of RAM, a 1.3GB hard disk, a crisp Super VGA 10.4-inch active-matrix display, and built-in stereo speakers and a microphone to complement its 16-bit sound capability. All this fits into the Solo S120's 2-by 11.8-by 8.8-inch case.

The Solo S120 offers a high level of modularity. The floppy

disk drive can be traded for a double-speed CD-ROM drive and the hard disk can be removed easily for a potential future upgrade.

With its 7-pound-6-ounce travel weight, the Solo S120 will serve the road warrior well. The system's weak point is its battery life; the lithium ion battery lasted only 1 hour 52 minutes on our WinDrain test.

The Solo S120 uses a touchpad called an EZ Pad as a pointing device and integrates one Type III PC Card slot, which can also accommodate a pair of Type II cards. The system also comes equipped with a wireless infrared port and includes an external infrared device for your PC to facilitate file transfer between desktop and portable machines. Like its 75- and 90-MHz predecessors, the Solo S120 has two Windows 95-specific keys on its keyboard.

The unit's performance on our benchmark tests was strong though not exceptional. It didn't excel in any particular area but was not far off the pace on all tests.

The double-speed CD-ROM drive was capable of 308-kilobyte-per-second (KBps) throughput and had an access time of 323 milliseconds (ms). Though these CD-ROM test results are quite slower than those of the Tecra 700CT's quad-speed CD-ROM drive, the Solo S120's CD-ROM drive had a lower CPU utilization score.

This is a fully configured notebook PC that includes a 28.8-Kbps PC Card fax modem and comes loaded with Microsoft Office 95, Works, and Golf.

BENCHMARK TESTS



Pentium/120 Notebooks

The HP OmniBook 5000 CTS consistently outperformed other Pentium/120-based systems, posting a particularly impressive Winstone 96 score of 50. The Gateway Solo S120 also turned in strong results, but it lagged on our battery-life test. Dell's Latitude

XPi P120ST fared only slightly better than the Pentium/90-based IBM ThinkPad 760 CD, while Toshiba's Tecra 700CT yielded middle-of-the-road scores but excelled in terms of battery life.

To measure performance, we used Winstone 96, Version 1.0. In addition, we used our WinDrain test to gauge battery life. Each system was equipped with 16MB of RAM.

Higher scores represent better performance
Red type denotes first place

	Winstone 96	Graphics WinMark 96 (Mpixels/sec)	Disk WinMark 96	CPUmark ₁₆	CPUmark ₃₂	WinDrain (hours: minutes)
Dell Latitude XPi P120ST (Pentium/120)	39	9.1	611	183	156	2:22
Gateway Solo S120 (Pentium/120)	45	10.8	618	198	189	1:52
HP OmniBook 5000 CTS (Pentium/120)	50	12.1	717	223	214	1:44
IBM ThinkPad 760 CD (Pentium/90)*	38	11.9	628	143	131	2:00
Toshiba Tecra 700CT (Pentium/120)	43	10.2	636	188	185	2:31

* Reported for comparison

First Looks

On the whole, the Solo S120 will force many to reconsider their current notions of what a notebook PC can be.—WPF

Solo S120. List price: With Pentium/120 CPU, 256K external cache, 16MB RAM, 1.3GB hard disk, 10.4-inch active-matrix display, double-speed CD-ROM, 28.8-Kbps PC Card modem, \$5,999. Gateway 2000 Inc., North Sioux City, SD; 800-846-4204, 605-232-2000; fax, 605-357-1023.

Circle 497 on reader service card

HP OMNIBOOK 5000 CTS

Hewlett-Packard's \$7,120 OmniBook 5000 CTS is caught between two notebook worlds. Though the OmniBook 5000 includes a sound system, stereo speakers, and some video features, it does not have an internal CD-ROM option. What the OmniBook 5000 does have to offer is a SCSI data bus in addition to the expected PCI bus and unrivaled notebook performance—although at a high price tag.

Based on a joint design and manufactured by Twinhead of Taiwan, the OmniBook 5000 has a travel weight of 7 pounds 13 ounces. This makes it slightly heavier than the Solo S120 but much lighter than the Tecra 700 CT—both of which include CD-ROM drives. The OmniBook 5000 includes a full-size keyboard and a trackball and measures 2 by 11.8 by 8.9 inches. The system's back panel includes an infrared wireless data-transfer window as well as a full array of connector ports.

The OmniBook 5000 we evaluated came equipped with 16MB of RAM, 256K of external cache, a 1.2GB hard disk, and a brilliant and rich 10.4-inch active-matrix screen. Unlike the Latitude XPI, Solo S120, and the Tecra 700CT we reviewed here, the OmniBook 5000 can display only 640-by-480 resolution. The graphics subsystem uses 1.5MB of VRAM and the display is fed with data by a Chips & Technologies 65545 chip set.

In addition to the 16-bit Sound Blaster-compatible sound system, a pair of speakers, and a microphone, the system has a

POWER PLAY: The OmniBook 5000 CTS sets a new standard for speed in a notebook.

VGA-out port for simultaneous display on a PC monitor. The OmniBook 5000 is also equipped with a NTSC/PAL video-out jack, which lets you connect the system to a television set. It includes a Type III PC Card connector that can be used with two Type II cards.

Performance was nothing short of exceptional and the system set records in all benchmark test categories. The OmniBook 5000 was about one-third more powerful than the 120-MHz Pentium Latitude XPI or the 90-MHz Pentium ThinkPad.

The OmniBook 5000's only shortcoming was its nickel hydride battery life, which lasted 1 hour 44 minutes between charges. There are a rich variety of power-conservation settings so that you can customize the system to your work habits and stretch the battery to a longer life.

Built for the mobile worker who does not need a built-in CD-ROM drive, the OmniBook 5000 CTS is the current power notebook of choice.—Brian Nadel

HP OmniBook 5000 CTS. List price: With Pentium/120 CPU, 16MB of RAM, 256K of external cache, 1.2GB hard disk, 10.4-inch active-matrix screen, \$7,120. Hewlett-Packard Co., Corvallis, OR; 800-443-1254, 503-715-2004; fax, 503-715-5488.

Circle 498 on reader service card



TOSHIBA TECRA 700CT

The \$5,999 Tecra 700CT has all the amenities that one would expect from a high-end notebook along with a few features borrowed from high-end desktop PCs. The only thing separating this system from today's desktop Pentium PCs is the Tecra 700CT's lack of an external-cache option. But by using an exotic form of memory chips, Toshiba narrows the gap between having and not having external cache.

The Tecra 700 CT's features include a 120-MHz Pentium processor, 16MB of RAM, a 1.2GB hard disk, an 11.3-inch active-matrix screen capable of 800- by 600-pixel Super VGA graphics, and a PCI-based graphics chip set that had 1MB of EDO RAM. The package is topped off with an internal quad-speed CD-ROM drive and integrated stereo speakers, as well as a Sound Blaster-compatible sound system.



MINI-MEDIA: The Tecra 700CT comes equipped with a quad-speed CD-ROM drive and stereo speakers.

The Tecra 700CT uses a lithium ion battery and its battery life was the best of the roundup at 2 hours 31 minutes, which was a little more than half an hour longer than that of our comparison notebook, the ThinkPad. The unit's 8-pound 14-ounce travel weight (measured without the external floppy disk drive) is on the heavy side; even without any extra baggage such as the diminutive AC adapter and cords, the Tecra 700CT still weighs in at 7 pounds 14 ounces.

The notebook's design features a recessed keyboard and a pointing stick in the center of the keyboard with the semicircular actuator buttons centered below it. The speakers are located above the keyboard and between them is a volume control. This is a nice touch but the control is awkward to use and we found ourselves relying more on Windows 95's software volume-control feature instead.

On the rear of the machine there are ports for a microphone and external speakers as well as ports for an external mouse and keyboard and a docking station. There is one Type III PC Card slot, which can be used for a pair of Type II cards; the unit also features an integrated infrared device to facilitate data transfer between machines.

With the Tecra 700CT, Toshiba inaugurates the use of synchronous DRAM for the unit's memory system. This lets the Tecra 700CT squeeze out every last ounce of performance despite its lack of external processor cache. The goal is to provide performance equivalent to that of a similar system with 256K of external cache.

On the whole, the Tecra 700CT was an average performer compared with the other Pentium/120 systems. Across the board, the Tecra 700CT's scores were better than those of the Latitude XPI but below those of the OmniBook 5000; both of those units came with 256K of external cache. The unit's CPUmark₁₆ and CPUmark₃₂ scores were also better than the Latitude XPI's and just slightly lower than the Solo S120's. Our CD-ROM tests showed the system is up to its billing as a quad-speed unit with a 613-KBps throughput and a 213-ms access time.

Packed with features, the Tecra 700CT leaves you wanting for little, except maybe a lighter load.—WPF

Tecra 700CT. List price: With Pentium/120 CPU, 16MB RAM, 1.2GB hard disk, 11.3-inch active-matrix display, quad-speed CD-ROM, \$5,999. Toshiba America Information Systems Inc., Irvine, CA; 800-999-4273, 714-583-3999; fax, 714-583-3800.

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Access 95

Continued from page 37

dows 95 Briefcase as the interface, Access 95 lets you update remote copies of a database with a local design master. Users can make changes to rows in the remote replicas and merge those changes with the master database. Changes made in the master can also be propagated to the replicas. This allows designers to do load balancing, distribute application updates, manage remote changes, or even synchronize changes between notebook and desktop databases.

Microsoft has made an already easy-to-use program even easier to use. Novices will like the Database Wizard, which generates a complete application from among 20 templates. If you're moving existing flat-file data to Access 95, you can use the Table Analyzer to scan your data for patterns. The wizard then suggests a normalized table structure that includes primary keys and creates the tables and relationships. The Table Analyzer is not perfect but it can familiarize beginners with Access 95.

A new Simple Query Wizard lets you specify the fields you want in the query result and then generates the tables and joins you'll need. When viewing a table in datasheet view you can insert and delete columns, as you can in Microsoft Excel. Access 95 will

automatically determine the data type based on the information.

Once you have your database up and running, the Performance Analyzer Wizard can optimize it. The Performance Ana-

lyzer works with the Jet engine to improve performance, such as by adding an index or changing a data type.

Access 95 now supports every popular query technique. New to this release is Filter By Form. With Filter By Form, you click on a toolbar button and your form becomes an empty skeleton in which you enter "match" criteria. To specify example values, you type them in or select them from pick lists. You can also call up the Expression Builder to help create

the selection criteria. When you're done, just click on the toolbar button and Access applies the filter.

Filter By Selection lets you specify the value you're searching for by highlighting it in a form or

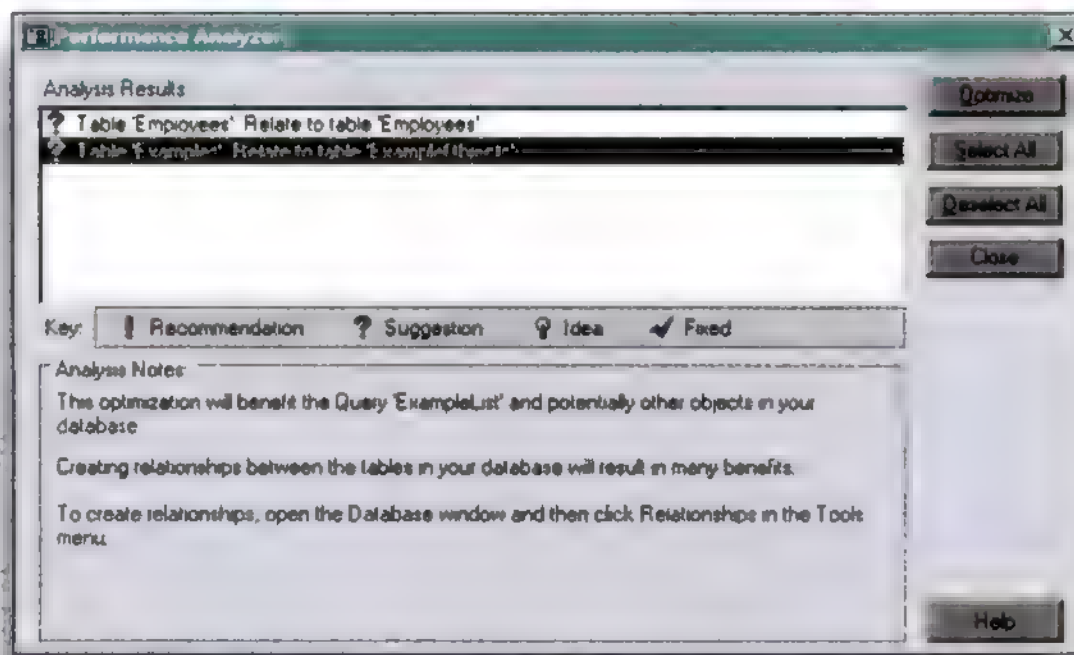
with color-coded syntax and an improved debugger with watch points. Developers will also appreciate new support for multiinstance forms, easy on the fly changing of control types, a database-splitter wizard that separates an application from its tables, and an object browser.

Though Access 2.0 could drive other OLE applications, it was not actually an OLE automation server. Now applications that support OLE automation, such as Excel or Visual Basic, can take control of Access 95. This makes greater integration possible between Access 95 and other OLE automation applications.

All of these impressive features and enhancements come at the cost of increased resources: You'll need at least 12MB of RAM, although 16MB provides more breathing room; the program wants 42MB of hard disk space for a full installation.

Access for Windows 95 is an impressive product no matter how you look at it. If you have the resources, upgrade right away. If not, you're missing out.

Microsoft Access for Windows 95. Estimated street price: \$339; upgrade, \$129. Requires: 12MB RAM, 14MB hard disk space, Microsoft Windows 95 or Windows NT. Microsoft Corp., Redmond, WA; 800-426-9400, 206-882-8080. Circle 434 on reader service card



SPEED THE FLOW: The Performance Analyzer Wizard works in tandem with the Jet Database Engine to speed up your database.

lyzer works with the Jet engine to improve performance, such as by adding an index or changing a data type.

Access 95 now supports every popular query technique. New to this release is Filter By Form. With Filter By Form, you click on a toolbar button and your form becomes an empty skeleton in which you enter "match" criteria. To specify example values, you type them in or select them from pick lists. You can also call up the Expression Builder to help create

datasheet. Click the appropriate toolbar button and Access 95 applies the filter. You can further narrow the set of records by highlighting another value and clicking the toolbar button again.

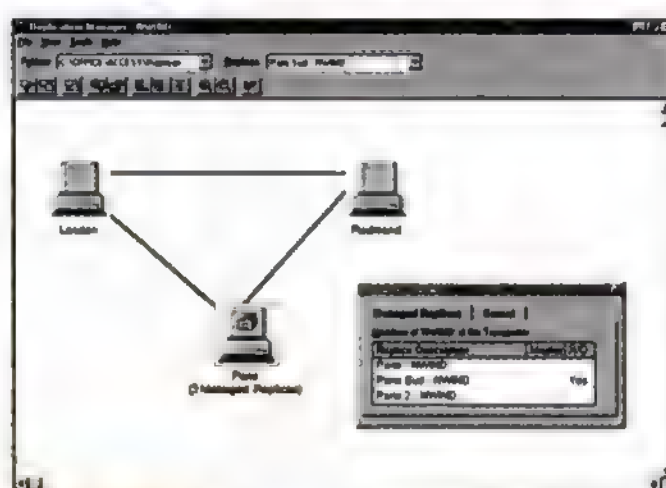
Access Basic has been replaced with Visual Basic for Applications (VBA), the same programming language used in Excel and Microsoft Project. This is a big plus for Office developers who previously had to deal with Access Basic and VBA. There's also an improved editor

Access 95 ADT: The ABCs of Custom Applications

If you're using Access 95 to develop custom applications, you'll need the \$499 Microsoft Access for Windows 95 Developer's Toolkit (ADT), which should be available by the time you read this.

The ADT comes with a royalty-free runtime license and the Setup Wizard, both of which are key to packaging Access 95 applications for distribution. But the ADT goes beyond distribution by providing a Replication Manager (RM) and a Transporter, a tool for managing database replication. The RM lets you graphically set up a replication network and, along with the Transporter, schedule updates.

The ADT also includes such Windows 95 OLE controls as Data Outline, common dialog boxes, Spinbutton, rich text format, Image List, List View, TabStrip, toolbar, Tree View, Progress, Status Bar, and Slider



ON SCHEDULE: The ADT includes the graphical Replication Manager, which lets you manage replication networks.

for use in your applications.

Developers hungry for more information will appreciate the Office Compatible Basic Toolkit for 32-Bit Products (OCBT) and the two-volume Visual Basic for Applica-

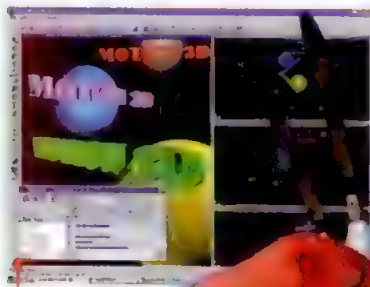
tions printed-language reference. The OCBT shows you how to create applications that meet the requirements for the Office Compatible logo. The reference includes the Microsoft Access Language Reference and the Microsoft Office for Windows 95 Data Access Reference.

A Win32 API declarations file is included as well. This is handy for developers who need to make direct calls to the Win32 API. Also included are the Microsoft Graph runtime executable module, the new Windows 95 Help Compiler for creating custom help files, and a bonus CD containing white papers, articles, and information from the Microsoft Developer Network (MSDN).

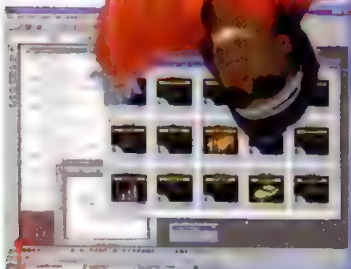
All told, the Microsoft Access for Windows 95 Developer's Toolkit is a clearinghouse of tools and information that developers will find essential.—SR

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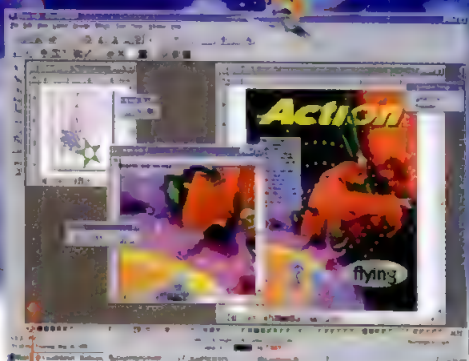
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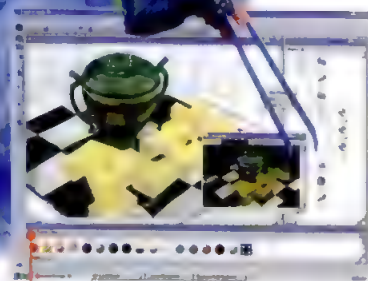
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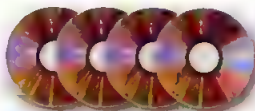


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WORKSTATIONS

Sun Ultra 1: Unparalleled Performance, but at a Price

By Brian Nadel and Nick Stam

As systems based on the Pentium Pro processor become commonplace, Sun Microsystems Computer Corp. leaps frogs Intel's best with its third-generation Sparc workstation microprocessors and systems. Sun's Ultra 1 Creator 3D Model 170E was head and shoulders above the Pentium Pro on some tasks—and on a par with it on others—but at \$27,995 the system's cost is more than three times that of a typical Pentium Pro system.

The centerpiece of the Ultra 1 is obviously the 64-bit UltraSparc chip, the latest and most powerful chip in the Sparc family. The Ultra 1 uses Sun's Solaris 2.5 Unix operating system and will likely set the pace for RISC workstations for years to come.

CHIP OFF THE OLD BLOCK

At 167 MHz, the UltraSparc chip is faster than Intel's newest Pentium and Pentium Pro CPUs but is a far cry from Digital Equipment Corp.'s fastest Alpha chip, which runs at nearly twice that speed. Based on a nine-stage pipeline design with branch prediction, the UltraSparc chip is rated at 240 SPECint92 for integer math and 350 SPECfp92 for floating-point operations. This rating for integer operations is marginally higher than that of the 150-MHz Pentium Pro CPU, but the floating-point calculations rating is more than double that of the 150-MHz Pentium Pro.

If that isn't enough data churning power, the UltraSparc chip—like the Pentium and Pentium Pro processors—supports symmetric multiprocessing with up to four CPUs. Each UltraSparc chip can support 0.5MB, 1MB, 2MB, or 4MB of external cache, compared with the Pentium Pro's current 256K maximum of built-in external cache; Intel is currently working on a 512K-cache version of the Pentium Pro CPU.

A quality high-end workstation requires more than just a



fast chip and the Ultra 1 also features a good balanced system design. The system board runs at half the speed of the CPU and draws from memory through an extremely wide 288-bit memory path from the motherboard's eight 64MB SIMM slots. The Ultra 1's memory path is twice as wide as that of HP's Pentium Pro design, which is used on the Vectra XU system. Denoting its high-end audience, memory on the Ultra 1 uses memory error correction code (ECC).

The Ultra 1 relies on Sun's UltraSparc Port Architecture, which uses an innovative high-speed crossbar packet switch in-

terconnection design between the processor, memory, and I/O devices. Sun engineers were able to boost typical data flows from memory to 300 megabytes per second (MBps) and get a peak



ULTRA SPEED: The heart of the Ultra 1's CPU is the new 167-MHz UltraSparc chip (inset), which outperforms Pentium and Pentium Pro CPUs.

throughput of 1.3 gigabytes per second (GBps).

About the only thing the Ultra 1 lacks is a PCI bus to take advantage of the variety of cards available. Sun is working on a PCI version, but for the time being users will have to content themselves with using the system's two S-bus connectors. In

addition, the system has 16-bit audio on-board, but it is not Sound Blaster-compatible.

Unexpected design touches abound in the Ultra 1, from the keyboard-controlled power switch and monitor adjustments to the hinged case, which opens with two spring-loaded screws. To help keep things cool, there are several strategically placed cooling towers.

The Ultra 1 breaks new graphics ground. The system's 2D/3D frame-buffered graphics card holds 15MB of 3DRAM, which Sun claims is about five times faster than standard VRAM. With the included 20-inch Sony Trinitron monitor, the Ultra 1 is capable of 24-bit color at 1,280-by-1,024 resolution at up to a 76-Hz refresh rate. Neither of our comparison systems (the Micron Millennia P133 and the Micron Pro 150 Magnum Plus) was capable of this combination of resolution and color depth; they were tested at 1,024-by-768-pixel resolution with 24-bit color.

Housed in a "deep-dish" pizza-box case, the system we looked at included a Sun-designed Fast/Wide SCSI controller that was connected to a Toshiba quad-speed CD-ROM drive and 2.1GB Seagate hard disks. The system also included a Fast Ethernet controller that is capable of 100-megabit-per-second (Mbps) throughput.

PROGRAMMED FOR EXCELLENCE

The proof of any workstation of this caliber is its graphics and programming performance, and the Ultra 1 doesn't disappoint on either score. We tested the Ultra 1 against the Micron Millennia (Pentium/133) and the Micron Pro 150 (Pentium Pro/150) systems using a variety of application-based benchmark tests to perform a range of tasks.

We used 32-bit versions of the test applications compiled for the Micron Millennia and Micron Pro 150, and Sparc-V8-compliant "compatibility-mode" applications for the Ultra 1 (except for

BENCHMARK TESTS



Sun Ultra 1 Creator 3D Model 170E

The Sun Ultra 1 easily outperformed the Pentium-based systems on the AutoCAD and C++ Compiler tests. But the 150-MHz Pentium Pro-based Micron Pro 150 Magnum

Plus and the 133-MHz Pentium-based Micron Millennia P133 rivaled the speed of the Sun Ultra 1 on the Photoshop tests. Each system had 64MB of RAM; the Sun Ultra 1 was set to 1,280-by-1,024 resolution, while the comparison PCs were each set to 1,024-by-768.

Lower scores represent better performance.

	Excel Macro Script (min:sec)	Word Macro Script (seconds)	AutoCAD (min:sec)	Photoshop Lighting Effects (seconds)	Photoshop Gaussian Blur (seconds)	Photoshop Sharpen Edges (seconds)	C++ Compiler (min:sec)
Micron Millennia P133 (133 MHz)*	0:49	33.2	5:51	51.1	21.8	16.1	4:17
Micron Pro 150 Magnum Plus (150 MHz)*	0:45	28.1	4:07	38.7	8.8	16.7	2:29
Sun Ultra 1 Creator 3D Model 170E (167 MHz)	2:25	82.2	2:27	47.7	7.9	13.2	1:01

* Reported for comparison.

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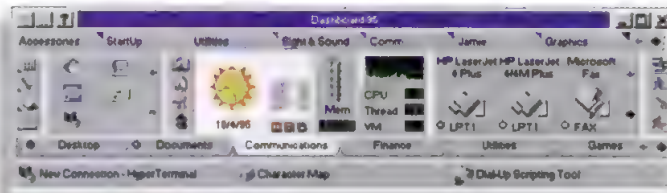
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WINDOWS 95 UTILITIES

Dashboard 95: So Many Functions, So Little Space



TIGHTLY PACKED: Dashboard 95 crams all essential Windows features and controls into a single control panel.

By Edward Mendelson

Dashboard 95 is a compact, ingenious, customizable control panel for everything you do in Windows 95—plus a few things you can't do with the basic Windows 95 package. The latest version of Starfish Software's \$49.95 classic utility adds some Windows 95-specific enhancements, but it hasn't kept up with the advances in interface design found in Windows 95 itself.

Dashboard gives you access to all your programs, system utilities, printers, multiple desktops, resource monitors, and a command line. But if your system has more than a half-dozen program groups, you may find Dashboard too cluttered and inconvenient.

If you enable all of Dashboard's features, it displays a dozen sets of controls. A button panel launches the Windows 95 Explorer, Find dialog boxes, and

other built-in Windows 95 features, as well as other button panels for Dashboard itself.

A gallery displays thumbnails of three to nine virtual screens. Other panels include resource gauges, icons that let you change the default printer with a mouse click, an alarm clock and calendar, and some time-wasting games. At the top are tabs representing the submenus of the Programs listed on your Start menu. At the bottom are tabs for launching programs, recently used documents, or the icons on your desktop. An equivalent of the Windows 95 Taskbar appears below these tabs. An undocumented trick lets you use Dashboard as the Windows shell by inserting `shell=dash.exe` in the `SYSTEM.INI` file.

You can hide almost any of these controls and snap some off as floating toolpads, but the program still suffers from having too

many features packed in too little space. When you customize a feature to work well in one situation, it tends to work badly in others. If you select the option that puts labels as well as icons on program buttons, you get large, labeled icons in all button pads, and you have to fuss with tiny spin buttons if you want to see all the icons.

The tabs on top of the panel display only one level of each cascading menu at a time, so you can easily get lost in the tree. You need to use the spin buttons to scroll back and forth along a row of tabs to find the ones that aren't on-screen, unlike the multiple rows of tabs used by Windows 95 that let you see all the tabs at once.

In addition, we found that resizing Dashboard's panels is an exercise in frustration, because adjustments you make in separate panels tend to be undone when you resize the whole window. We experienced some crashes when using many features at once.

Dashboard fits on one disk and, if your Windows 95 system is equally minimal, you may find it indispensable. But with more elaborate systems, this Dashboard too often gets in the way of the windshield.

Dashboard 95. Estimated street price: \$50. Requires: 4MB RAM (8 MB recommended), 3MB hard disk space, Microsoft Windows 95. Starfish Software, Scotts Valley, CA; 800-765-7839, 408-461-5800; fax, 716-873-0906.

Circle 501 on reader service card

the Gaussian Blur task on our Adobe Photoshop tests, which is Sparc-V8+-compliant). Tests included the Photoshop tests, the AutoCAD test, and a World-Wide Web server and client source-code compilation test; we used Version 7.2 of Symantec's 32-bit C++ compiler for the Micron Millennia and Micron Pro 150 and Sun's own Sparc C 4.0 compiler. We also tested the 32-bit versions of Microsoft Excel and Word on the Micron Millennia and Micron Pro 150 and comparable 16-bit versions of Excel and Word under Sun's WABI Windows 3.1 emulation environment. All tested systems had 64MB of RAM.

OUT IN FRONT

The Ultra 1 outperformed the Micron Pro 150 on the AutoCAD test by 49 percent—testimony to its graphics-intensive nature and its use of exotic 3DRAM. The Photoshop test results were mixed, with the Ultra 1 barely beating the Micron Pro 150 on the Gaussian Blur and Sharpen Edges tasks; the Ultra 1 finished midway between both Micron units on the Lighting Effects task.

The standout score for the Ultra 1 came on our C++ Compiler Test, where its time was one-third and one-quarter that of the Micron Pro 150 and Micron Millennia, respectively. The Ultra 1 delivered respectable Excel and Word scores, approximating the performance of a 486DX2/66 PC, which is not bad for emulated software.

Brimming with high technology and priced that way, the \$27,995 Ultra 1 sets a new standard for workstation manufacturers. But if you're willing to lower your sights slightly, any of today's emerging Pentium Pro systems can nearly match the Ultra 1 in terms of performance without emptying your wallet.

Sun Ultra 1 Creator 3D Model 170E. List price: With Ultra-Sparc/167, 512K of external cache, 64MB of memory, 2.1GB hard disk, quad-speed CD-ROM, 20-inch monitor, \$27,995. Sun Microsystems Computer Co., Mountain View, CA; 415-960-1300; fax, 800-821-4643.

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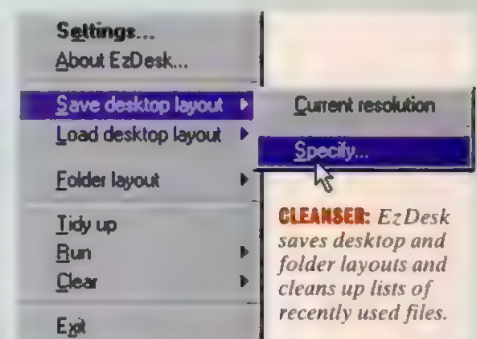
EzDesk: The Essential Desktop Cleaner

Tired of wasting time moving Windows 95 desktop icons exactly where you want them and resizing the Control Panel window every time you open it? You need EzDesk, a \$15 utility from EzWare Technology that is available from the company's CompuServe address: 70571.637.

You can place EzDesk's icon in the system tray on the Taskbar or make it invisible and access it through a hotkey.

EzDesk can automatically change layouts when you change screen resolutions and can automatically save any changes in your layout when you shut down Windows. Alternatively, you can set the program to ask you if you really want to save the layout at shutdown.

Other options from EzDesk's pop-up menu



save the size and layout of open folders, clear the recent file lists in the Start menu and separate applications, and perform other tedious cleanup jobs with a keystroke.—EM

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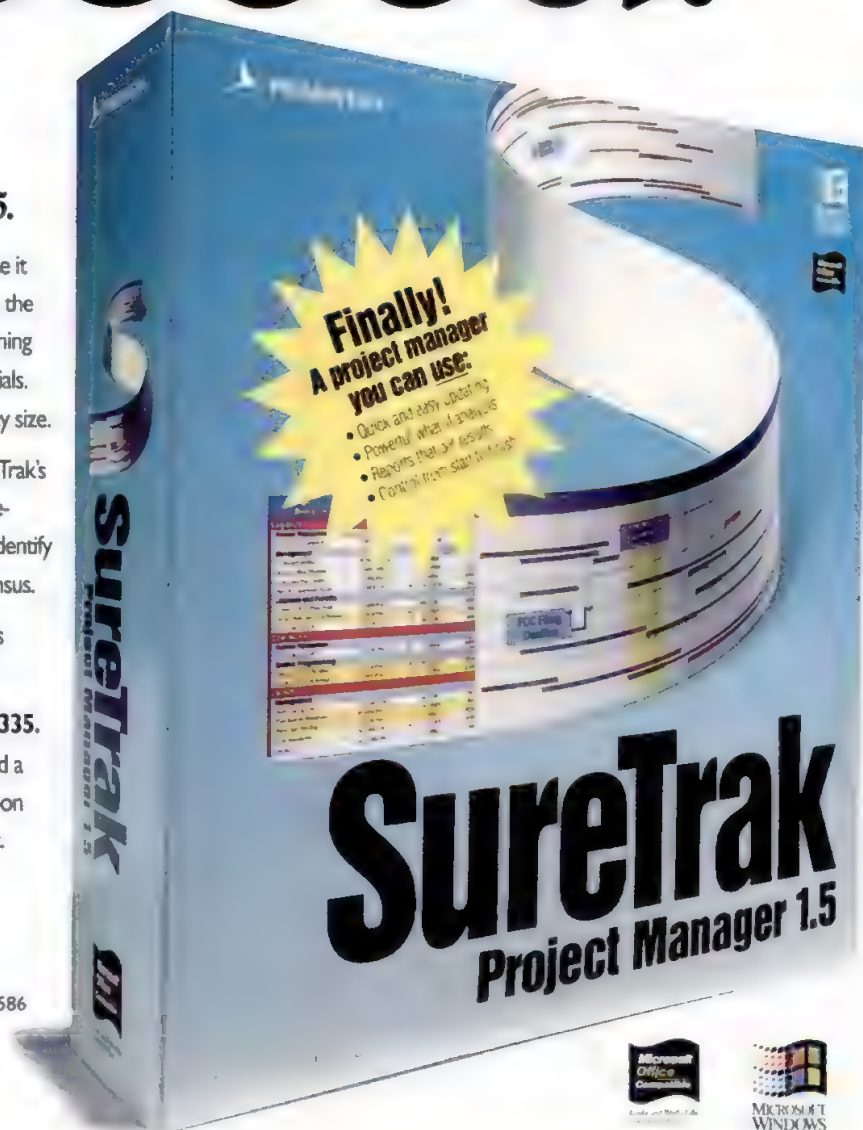
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INTEGRATED SOFTWARE

OfficeBlox: Five Easy Modules

By Ben Z. Gottesman

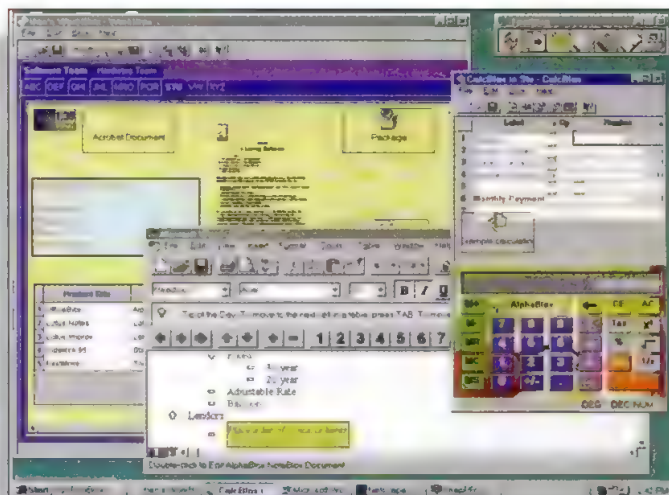
AlphaBlox's \$69.95 OfficeBlox is a useful collection of Windows 95 productivity applets. These applets, called Blox, perform a variety of functions for which a full-blown application would be overkill. The initial release includes five Blox: a notepad, a calculator, a database, an organizer, and a taskbar, with the company promising more.

The center of attention is ToolBlox, a toolbar reminiscent of earlier versions of Microsoft Office Manager, from which all the other Blox (and any other programs you choose) can be launched. NoteBlox is a convenient way to enter notes. There are templates for to-do lists or addresses and notes (such as phone messages or idea reminders), but the current version only supports a single font; users will receive a free upgrade that supports rich text format.

WorkBlox provides a workspace for storing virtually any item, be it another Blox, an OLE object from another application, a file, or a folder. The WorkBlox can be divided into tabs and subtabs. The program can automatically generate tabs for the day, month, and year as well as a variety of alphabetical subtabs. CalcBlox is a cross between the Windows calculator and a spreadsheet. There's an adding-machine tape and multiple columns in which users can assign labels to their data. The program comes with a variety of templates for common calculations such as mortgage payments and depreciation schedules.

ListBlox is a flat-file database that supports standard data types as well as yes/no fields and traffic lights. A double-click on a traffic-light field changes the color from green to yellow to red, which can set priorities. Data can be entered directly or from an ODBC source. All the Blox make extensive use of OLE 2.0, acting as both servers and containers. The result of a CalcBlox session can be dragged into a word processing document. Or Blox can be stored inside of other Blox. Each Blox has a button on its Microsoft Office-compatible toolbar for embedding or linking it inside another program. We found the program was sluggish, even on a Pentium/90 with 16MB of RAM.

AlphaBlox has promised additional Blox, including AlarmBlox and ThinkBlox, which is an outliner. OfficeBlox gives users a useful set of tools that might help move some familiar office tools off the



WORK IT OUT: There are a variety of included AlphaBlox templates, such as this one for calculating mortgage payments.

desk and onto the computer. **OfficeBlox.** List price: \$69.95. Requires: 8MB RAM, 20MB hard disk space, Microsoft Windows

95. AlphaBlox, Burlington, MA; 800-451-1018, ext. 117; 617-229-2924.

Circle 408 on reader service card

PROJECT MANAGEMENT

SuperProject 4: Heavy-Duty Project Manager Invites a Broader Audience

By Craig Stinson

The \$649 CA-SuperProject 4 aims to broaden the appeal of the Computer Associates program that over the years has earned a reputation for both capacity and opacity.

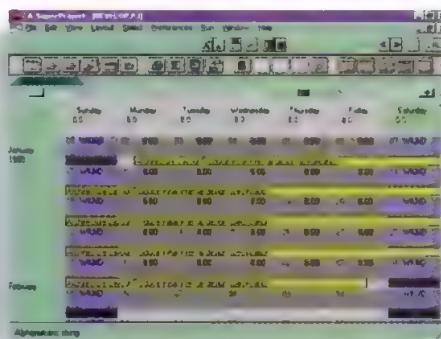
A 16-bit Windows application (it runs in any version of Windows but doesn't support long filenames), SuperProject 4 leads with bubble help, a multilevel undo capability, and a more inviting screen design. Spreadsheet-style notebook tabs, arrayed across the top of the screen, let you

switch among projects (when two or more are open) and among the various charts and tables.

There are configurable, dockable toolbars, but unfortunately they lack tooltips, so you'll need to read messages at the bottom of the screen to decode the icons. Tabbed dialog boxes and the

ability to access forms via right-mouse-clicks give the program an up-to-date appearance.

Via OLE, you can implant text and graphics from other Windows programs in SuperProject's



CALENDAR CODE: CA-SuperProject 4's redesigned calendars use colors to highlight lightly scheduled or heavily scheduled days.

tables and charts, and you can drive SuperProject from a variety of platforms, including Microsoft's Visual Basic. As before, SuperProject ships with Computer Associates' own Basic-like development tool, CA-Realizer, as well as TimeSheet Professional, a utility for tracking time and ex-

penses for projects, clients, and activities.

On the visual front, Computer Associates has made improvements to SuperProject's Gantt chart and calendar displays and has added a new company-wide organizational chart. The Gantt chart offers optional symbols to show must-start and must-finish conditions, as well as special symbols that highlight interproject dependencies. A new print-to-fit option simplifies the transfer of charts and reports to paper.

Though it is more discoverable overall, SuperProject still lacks serious support for the novice. You won't find wizards here, and both the tutorial and the PM Assistant—a Realizer application designed to step users through the process of creating a project—are rudimentary and awkwardly implemented.

CA-SuperProject 4 is a big step forward for Computer Associates. The program still handles tough jobs while shedding much of its tough exterior.

CA-SuperProject 4. List price: \$649. Requires: 8MB RAM, 12MB hard disk space, Microsoft Windows 3.1 or later. Computer Associates International Inc., Islandia, NY; 800-225-5224, 516-342-5224; fax, 516-342-3734.

Circle 407 on reader service card



From December 4 to 8, go on-line to download OfficeBlox and discuss it with Alpha Software cofounders Richard and Selwyn Rabins and Ben Z. Gottesman, a technical director at PC Magazine Labs. Type GO EXEC at any CompuServe! prompt.

KEYBOARDS

Three Keyboards That Put You in Touch with Your Work

By Melissa J. Perenson

Since touchpads are now the pointing device of choice on notebook PCs, it was just a matter of time before they made the leap to the desktop. Alps Electric, Cirque, and Northgate Computers are the first to offer keyboards with integrated touchpads, and they each do so with varying degrees of success.

These three keyboards provide interesting similarities and contrasts. Points of parity across the keyboards include the use of the Cirque GlidePoint touchpad technology, Alps' click/tactile mechanical key switches, Windows 95 shortcut keys (on the Alps and Northgate keyboards only), and the inclusion of some combination of two AT, serial, or PS/2 ports; in addition, the Alps and Cirque keyboards include port adapters. Beyond that, they each go their own way.

The \$139 Cirque GlidePoint Keyboard is the most basic design of the three keyboards. To make room for the touchpad, Cirque simply replaced the usual inverted-T cursor keys with the touchpad.

Although the pad's location is comfortable to use, the three custom-configurable mouse buttons require a keen sense of coordination, because they're located on the left side beneath the control keys. It's also a tremendous drawback not to have the cursor keys. On the positive side, the squarish, 2.3- by 2.2-inch pad has the largest surface area of those on these three keyboards.

The sleek \$149.95 Alps GlidePoint Keyboard reflects a more thoughtful design. Located beneath the cursor keys, the touchpad is accommodated within a gracefully curved extension of the keyboard. The three mouse buttons are located directly below and to the sides of the touchpad.

The biggest catches to this design are that the mouse buttons are somewhat awkward for repeated use, and the 2.1- by 1.6-inch rectangular touchpad is uncomfortably

recessed and smaller than the pad found on the Cirque keyboard. On the other hand, the Alps keyboard includes the Erase-Eaze Spacebar, which conveniently



TOUCHPADS GALORE: Northgate's OmniKey Evolution with GlidePoint (top) integrates a removable pad, while the Alps GlidePoint (middle) adds a touch of style. The Cirque GlidePoint (bottom) is the largest pad.

splits the Spacebar in two: The right side is the Spacebar and the left side is an extra backspace key.

There are also the three Windows 95 shortcut keys.

The appearance of Northgate's \$149 OmniKey Evolution with GlidePoint keyboard resembles the contoured split-keyboard design of the Microsoft Natural keyboard. But the Northgate keyboard's removable touchpad, situated beneath the centrally located cursor keys, would be

easier to use if it were located about a half of an inch lower down. Furthermore, although the idea of

having a touchpad that's removable and swappable with a pointing stick is a good one, it would also help if the pad's 2.2- by 1.5-inch surface was a little larger and more flush with the keyboard.

It would be hard to say that the first crop of touchpad keyboards have unequivocally hit their mark. But these three touchpad keyboard designs reinforce the belief that the choice of a keyboard is a very personal decision.

Alps GlidePoint Keyboard. List price: \$149.95. Alps Electric (USA) Inc., San Jose, CA; 800-825-2577, 408-432-6000; fax, 408-432-8337.

Circle 403 on reader service card

Cirque GlidePoint Keyboard. List price: \$139. Cirque Corp., Salt Lake City, UT; 800-454-3375, 801-467-1100; fax, 801-467-0208.

Circle 404 on reader service card

OmniKey Evolution with GlidePoint. List price: \$149. Northgate Computers Inc., Eden Prairie, MN; 800-548-1993, 612-947-4600; fax, 612-947-4607.

Circle 405 on reader service card

WIRELESS

Mitsumi's Wireless Mouse Throws Away the Cable

By Brian Nadel

If a tangle of desktop cables is coming between your mouse and your computer, Mitsumi's \$49.95 Wireless Mouse is a tangle-free solution. Based on sophisticated radio-frequency technology, the Wireless Mouse is easy to set up, works well, and looks just like an ordinary pointing device to your PC, except that there isn't a cord to get in the way.

The Wireless Mouse package consists of two parts. The first is a 300-character-per-inch mouse, which is similar in appearance to Logitech's MouseMan, except the Wireless Mouse has two buttons instead of MouseMan's three. That's where the second half of the package comes in: The 4- by 3- by 3-inch inclined radio receiver connects to the mouse via a 309.7-MHz radio-frequency link. The receiver draws power from the PC's serial port and the mouse uses a small internal lithium ion battery.

Setup of the Wireless Mouse is a 10-minute, three-step process

for Windows 95 systems. You start by plugging in the receiver's 6-foot serial cable. Then you load the driver and control-panel software and set the mouse's ID code, which involves pushing the end of a paper clip into a small hole on top of the receiver's green LED. Windows 95 has to recognize and configure the new mouse hardware, and then it's ready.

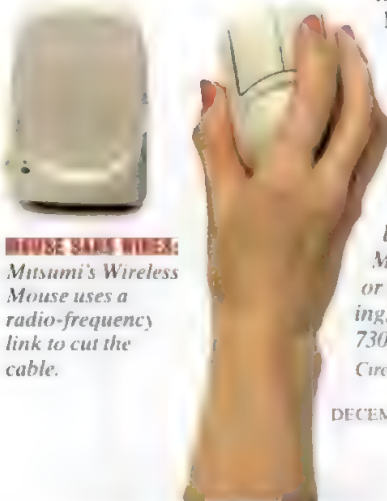
Once installed, the Wireless Mouse offers a rich array of software adjustments that make the

most of the hardware. During testing, we found that the effective distance of the wireless system was about 3 feet and up to about a 45-degree angle from the front of the receiver unit. If you find yourself under constrained desktop conditions, the range of angles at which the receiver can maintain a link with the mouse can be adjusted in the software. This lets you stash the receiver in an unobtrusive place.

Unlike early wireless pointing devices that used infrared transmissions, the Wireless Mouse doesn't lose contact if you move it quickly and works just as it would if it were a traditional cabled mouse, except that there aren't any wires to clutter your desk.

Mitsumi Wireless Mouse. List price: \$49.95. Requires: Microsoft Windows 3.0 or later, or DOS 5.0 or later. Mitsumi, Irving, TX; 800-648-7864, 214-550-7300; fax, 214-550-7424.

Circle 402 on reader service card



MOUSE SAYS WIRELESS: Mitsumi's Wireless Mouse uses a radio-frequency link to cut the cable.





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The Gateway Solo™ 120 Best Buy portable PC is sold with 16MB RAM and a 14.4. PCMCIA fax/modem. The accompanying ad insert incorrectly states that it is sold with 40MB RAM and a 28.8 PCMCIA fax/modem.



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SCANNERS

HP ScanJet 4c: The Quick, Easy, and Fast Color Scanner

By Alfred Poor

You don't need to be a professional graphics artist to scan color images for booklets, invitations, and presentations, thanks to Hewlett-Packard Co.'s color scanner, the ScanJet 4c. While it has enough sophistication to tackle publication-quality tasks, this 600-dot-per-inch (dpi) color scanner has been designed to be easy enough to use so that anyone can add a dash of color to their daily work.

The scanner, which has a list price of \$1,179, is expected to sell for under \$1,000. For speed and flexibility, the ScanJet 4c uses a SCSI interface; the package in-

cludes DeskScan II software provides a wide range of sophisticated features, including screen and printer calibration, thresholding, gamma adjustment, color correction, and filtering.

The DeskScan II software presents the user with a simplified face, although there's a lot of sophistication below the surface. For example, when the ScanJet 4c prescans your image, the unit guesses as to what type of image it is and how it should be scanned. Instead of citing bit depths and dpi measurements, the system lets you choose a picture type (such as "black-and-white drawing" or "millions of color") and a destina-

The scanning driver is Twain-compliant, so you can use it with any Windows application that supports this standard. You also get a copy of Visioneer's new document management software, PaperPort 3.0, with the scanner. PaperPort 3.0 lets you organize your scanned images and use links to send the images to other Windows applications, including graphics editors, fax utilities, optical character recognition (OCR) programs, and even word processors (using the OCR feature on the fly).

PaperPort 3.0 automatically establishes links to programs that it recognizes, including the two other applications that come bun-

powerful Windows program. This software converts your scanner and color printer into a capable color copier. The utility still uses the Windows print spooling system but makes it easy to scan and print in one step, as well as choose multiple copies, enlargement or reduction, or other features. If you have a fax driver installed, you can also use this program to fax hard-copy originals directly.

All of these features worked extremely well together on our tests. Compared with the ScanJet 3c that it replaces, the ScanJet 4c was blazingly fast. The ScanJet 4c managed to scan a 5- by 7-inch photograph at 200 dpi in just 17.6 seconds, which is about one-third of the 46 seconds needed by the ScanJet 3c.

At full resolution and color depth, the image quality was uniformly excellent, and it was difficult to improve on the automatic settings. Scans at the highest black-and-white settings bore out HP's resolution claims of 600-dpi resolution; the scanner successfully scanned a target image at a resolution of 559 dpi, and you could almost see the 635-dpi image (the next-highest-resolution image) from the test target.

A few details mar an otherwise well-thought-out piece of hardware. One welcome addition would have been if the Twain scanning-driver settings were "sticky," retaining the scan area and other adjustments from one scan to the next. The software currently scans a new preview image and resets the settings each time.

As with the ScanJet 3c, there is an optional 50-page automatic document feeder that carries a list price of \$559 and a transparency adapter for items from slides to letter-size overheads with a list price of \$759.

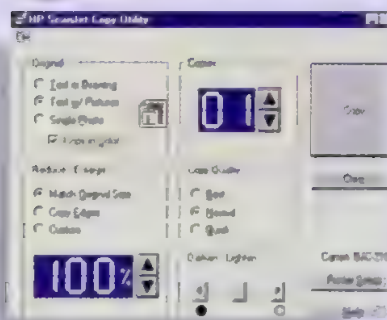
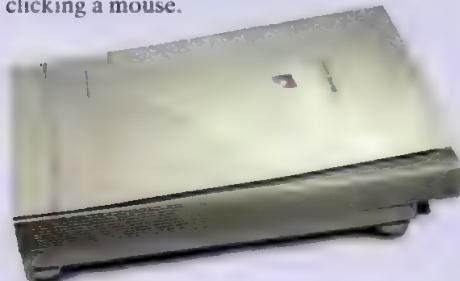
With so many features in its favor, the ScanJet 4c is not a scanner that you are likely to outgrow quickly.

HP ScanJet 4c. List price: \$1,179. Requires: PC with free slot or SCSI host adapter. Hewlett-Packard Co., Direct Marketing Organization, Santa Clara, CA; 800-722-6538, 208-396-2551.

Circle 435 on reader service card

EASY COLOR

The HP ScanJet 4c is a 30-bit, 600-dot-per-inch color scanner that is as easy to use as clicking a mouse.



COPY SHOP: The Copy Utility lets you turn the ScanJet 4c and a color printer into a color copier. Using sophisticated automated settings, output from the ScanJet 4c was uniformly excellent.

cludes a 16-bit ISA SCSI card that is easy to install. If you already have SCSI in your system, it has to include either ASPI or CAM support under Microsoft Windows 3.x or Windows NT, or Windows 95 support, for the ScanJet 4c to work.

The unit is capable of 600-dpi optical resolution (interpolated resolution up to 2,250 dpi), with up to 30-bit scanning support. The

tion (such as "Screen" or "HP Color LaserJet"). The ScanJet 4c then adjusts and optimizes those settings automatically.

The settings are manually adjustable if you wish. You can also specify resolution and color depth with a customized setting feature. The software also does a great job of automatically adjusting brightness, contrast, and color balance.

dled with the scanner. For photo image-editing, you get a copy of Corel Corp.'s Photo-Paint 5, and for OCR, there is a copy of Caere Corp.'s OmniPage Limited Edition. OmniPage supports the HP AccuPage 2.0 technology that's built into the ScanJet 4c for improved accuracy.

There's also a handy ScanJet Copy Utility, which is a small but

NETWORKING

Net 44: Instant Ad Hoc LAN

By Steve Rigney

Even after recent steep price declines, the cost of a peer-to-peer network runs about \$200 per system by the time you add the hardware, software, and the cable that connects the PCs together. If you just need to share printers, CD-ROMs, and occasionally data files, however, the \$249 Net 44, from Leunig Communications Inc. (LCI), allows you to network quickly up to four PCs running Microsoft Windows for Workgroups or Windows 95 using a standard parallel cable. The price you pay is performance: The Net 44 is limited to about half the speed of a standard Ethernet LAN, and distances between PCs are limited to 40 to 60 feet.

The Net 44 is housed in a chassis about the size of a Sony Walkman and includes four Centronics parallel ports for attaching the PCs and two standard parallel ports for connecting printers. Setup is quick and easy: We installed the Net 44 and began sharing files and printers within 10 minutes of opening the box.

Unlike printer-sharing devices and direct-cable file-transfer products, such as Traveling Software's LapLink, the Net 44 doesn't require any proprietary software to make the connection. Leunig engineers showed great initiative when they designed the communication software as an NDIS 3 Ethernet card driver. For example, you install the software on your PC running Windows for Workgroups or Windows 95 the same way you would install the drivers for a standard Ethernet adapter.

The Net 44 can also work with other network protocols, including IPX and NetBEUI. But because the Net 44 uses a NDIS 3 network driver, it will not work with DOS or Windows 3.1-only PCs.

Windows 95 includes a direct-cable data-transfer feature that allows you to connect two PCs and share resources between them. By contrast, the Net 44 can simultaneously connect up to four PCs and also offers two printer connections. The Net 44 also uses the

same interface and menus you would use with a standard Ethernet adapter installed in your Windows for Workgroups or Windows 95 client PCs.

If you need to share large amounts of data or access applications located on another PC, the Net 44 is probably too slow. But the Net 44 works with the ECP (Extended Capability Port) parallel-cable specification to increase network performance. We don't recommend using the Net 44 to access Lotus Notes or another database across a parallel-port

connection because of the amount of data involved. We do recommend the Net 44 for any small business with a limited budget and the need to share laser printers and data.

The Net 44 is a snap to install and you could use it to set up a "mini" network whenever the need arises.

Net 44. List price: \$249. **Requires:** 4MB RAM, 12MB hard disk space, Microsoft Windows for Workgroups or Windows 95. **Leunig Communications Inc., San**



INSTA-NET: The Net 44 can connect up to four PCs and a pair of printers via parallel ports.

Jose, CA; 800-441-6562, 408-441-6560; fax, 408-441-6562.

Circle 503 on reader service card

SCANNERS

RFS-3570 Turns Kodak Film into Faithful Digital Images

By Daniel Grotta and Sally Wiener Grotta

With Nikon's SuperCoolScan 2,700-dot-per-inch (dpi) 35-mm film scanner selling for \$2,400, why would anyone spend three times that for the 2,000-dpi Kodak RFS-3570 scanner? According to Kodak, the only thing you get by scanning 35-mm trans-

though Kodak recommends using a second SCSI board if your system boots off a SCSI hard disk.

Installation and setup were easy and uneventful. The Twain driver includes standard adjustments, such as crop, automatic white balance, RGB balance, and scale, among others. Kodak pro-

The unit must be calibrated and focused at start-up and every time a new film format or magnification factor is used. But making scans is fast and easy. Prescanning takes about 10 seconds, and actual 35-mm scanning at full resolution (which produces 18MB files) takes under a minute (with a test-bed Pentium/133 with 32MB of RAM).

We were impressed with the quality of the test scans. They were always sharp, well defined, and virtually free of artifacts. Unfortunately, there's no auto-

loader or software for performing unattended scans. And though Kodak gives a convincing argument against needing resolutions over 2,000 dpi, we'd still like the ability to scan smaller areas of a negative or transparency at full-frame resolution.

Overkill for occasional users, the RFS-3570 Film Scanner is right on target for high-volume graphics users for whom speed, ease of use, 120-mm capability, and dependability are paramount considerations.

RFS-3570 Film Scanner. List price: \$8,995. **Requires:** PC with SCSI host adapter, 16MB RAM (32MB recommended). **Eastman Kodak Co., Rochester, NY; 800-465-6325.**

Circle 502 on reader service card

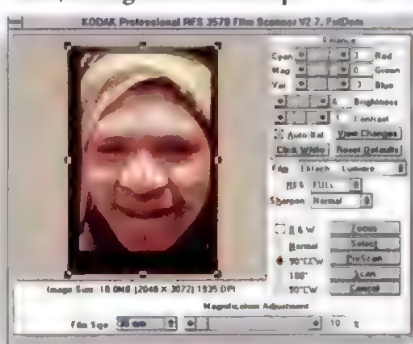


FILM TO PIXELS: The Kodak RFS-3570 Film Scanner turns transparencies and negatives into high-resolution digital images.

parencies at resolutions above 2,000 dpi is larger files, not better image quality.

Instead of playing the resolution numbers game, Kodak has loaded the RFS-3570 with better optics, superior scanning algorithms, 36-bit color depth, the ability to scan up to 120-mm film, and profiles on Kodak film for better scans.

At 17 pounds, the RFS-3570 is an industrial-strength scanner. Its SCSI interface works with any ASPI-compatible controller,



vides additional prescan functions: superfast image rotation, magnification adjustment, the ability to view a negative image instantly as a positive, three sharpen options, eight different film sizes, and profiles for 49 different Kodak film types. Our test scans show that using the correct film profile significantly improves color accuracy. The RFS-3570 does not provide film profiles for non-Kodak film.

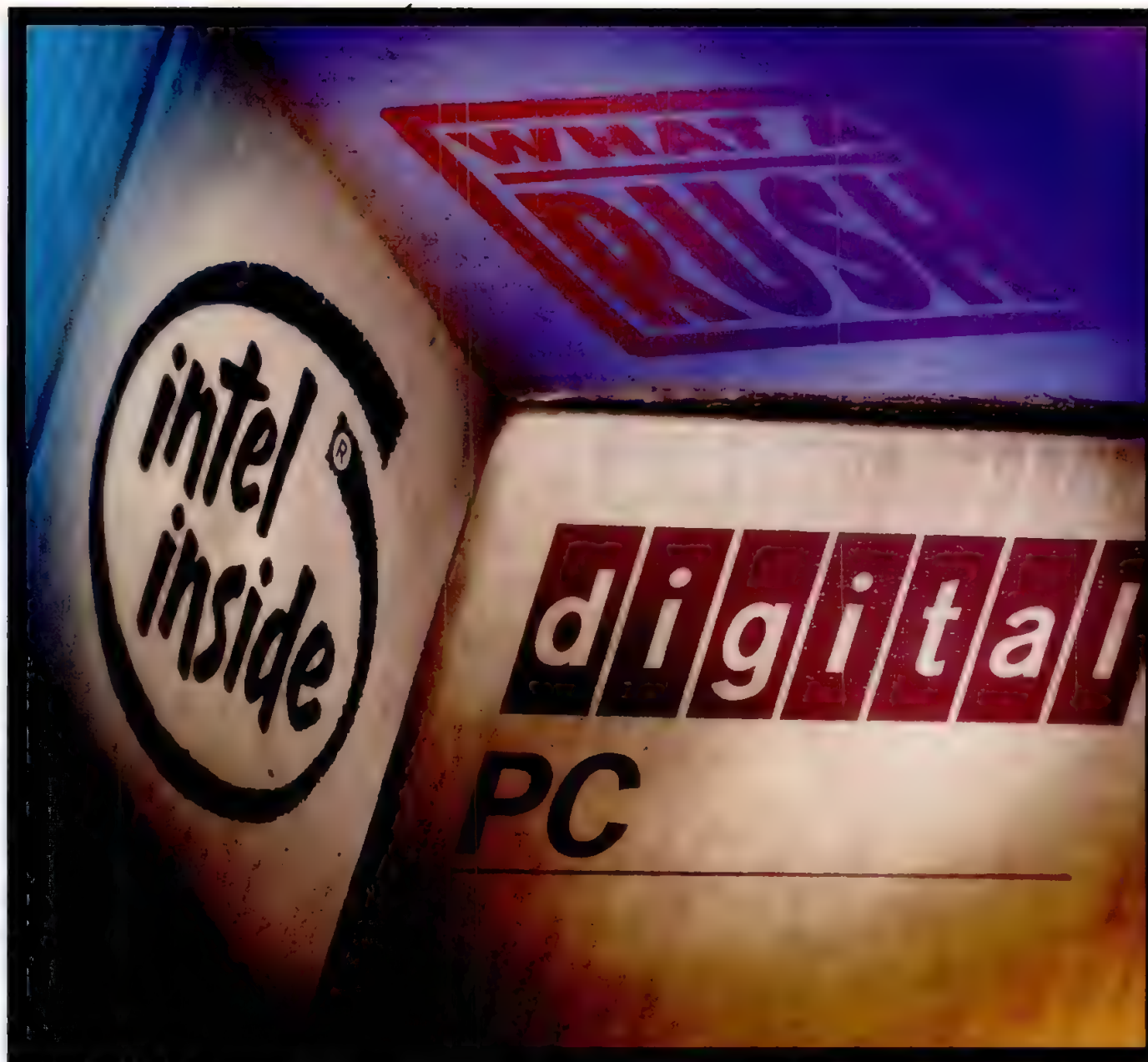
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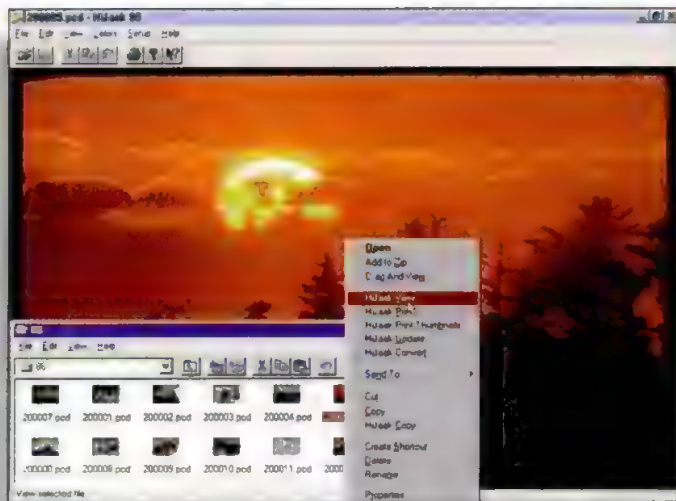


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First Looks



GRAPHICS

HiJaak 95 Extends Windows 95's Graphics Capabilities, but Slowly

By J.W. Olsen

Inset's \$49.95 HiJaak 95 extends the graphics-handling abilities of both Windows 95 and its applications so transparently that you hardly know it's there. But it is and the program works well.

HiJaak 95's presence is well concealed, yet it reveals itself whenever graphics needs arise. Whether you're in Windows 95's Explorer, My Computer, Network Neighborhood, or an application's Open dialog box, standard icons for graphics files are replaced with image thumbnails. This lets you preview images without having to open them or without having to use Windows 95's Quick View.

IMAGE INFO ON DEMAND

You can perform most HiJaak 95 functions by right-clicking the mouse on these icons to view and print images (or thumbnails), convert them, copy them, and more. The Properties item on the menu that appears when you right-click on these thumbnails yields extensive information about the files. HiJaak 95 removes the guesswork from file conversion by letting you select the target application and determine output format.

The Find command on Windows 95's Start menu and in Explorer has been expanded too. You

can search for a graphic based on a variety of characteristics—including colors and other attributes such as name, date, and location—or by keywords you assign or that HiJaak 95 gathers for you from within certain vector formats.

HiJaak 95 has augmented the File/Print function of Windows 95 with a new driver that "prints" any document into a graphics file. This will help those preparing complicated presentations, putting together World-Wide Web home pages, or performing other tasks.

To use some of its thumbnail-creating and image-tracking abilities, HiJaak 95 must monitor your system to maintain graphic catalogs of all images. This process can be invoked manually, set to run at a predetermined time, or implemented as a background task.

HiJaak 95 has graduated from its former OLE 1.0 server role to full OLE 2.0 compliance. For instance, if you bring an image into a Windows 95 workspace via drag-and-drop or Insert/Object, HiJaak 95 operates behind the

THUMBNAIL EXTRAVAGANZA:

HiJaak 95 replaces generic graphics-file icons with reasonably detailed thumbnails.

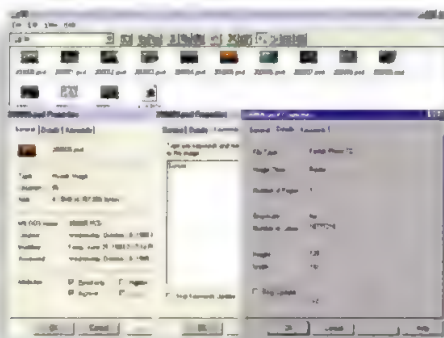
scenes to make any necessary format conversion.

HiJaak 95 is the clear leader in graphics-file conversion, supporting many more formats than any alternative, such as .PNG (the replacement for the .GIF format), Corel Metafile Exchange (.CMX), and Enhanced Windows Metafile (.EMF) formats. A versatile batch-conversion routine also is available from the Start menu's Run command line.

HiJaak 95 provides a wide range of image-editing features, including contrast, brightness, and gamma adjustment. In addition, you can resize, rotate, and crop images as well as reduce and replace colors; at any time, you can convert a color image into gray-scale or black-and-white.

IMPORT RESTRICTIONS

HiJaak 95 offers a lot but the program leaves you wishing for more. For example, if you need a specific format among those supported by the target application, you must manually invoke HiJaak 95's con-



PROPERTY VALUES: HiJaak 95 provides a wealth of information on graphics files.

version functions. Inset is exploring possible alternatives to permit users to designate a particular format during imports.

HiJaak 95 can't load multiple image files in MDI windows. So to compare files, you must use Explorer or My Computer to invoke two instances of HiJaak 95,

which can place a severe penalty on systems with less than 16MB of memory. A more serious problem is that 256-color display mode can cause significant dithering under some circumstances when compared with other graphics tools. Saving a file to disk and then opening it in another application or printing it reveals that all colors are properly retained. Also, HiJaak 95's color-editing functions sometimes require educated guesses.

Though not as extensive as in some alternatives, HiJaak 95's screen-capture options allow you some flexibility in defining areas to capture and output. In addition to full screen captures, you can capture user-defined rectangular areas, selected windows, and certain objects. A handy feature lets you select multiple windows or objects in a single capture. HiJaak Capture, a separate but included utility, can direct output to the main HiJaak applet, your printer, the Windows Clipboard, or a file.

Based on informal tests, this first-release product was slow. Depending on file size, system memory, and other factors, HiJaak 95 can take more than twice as long as Microsoft Paint—and more than five times longer than JASC's 16-bit Paint Shop Pro—to load graphics files from disk.

Screen capture directly to an on-screen window sometimes takes more than eight times longer in HiJaak 95 than in Paint Shop Pro. Inset acknowledges the problem and is working on optimizing performance.

With its exceptional behind-the-scenes work, its breadth of graphics-handling options, and its extensive format support, HiJaak 95 points the way for other Windows 95 graphics utilities to follow. **HiJaak 95.** Estimated street price: \$49.95. Requires: 8MB RAM, 12MB hard disk space, Microsoft Windows 95. Inset, Brookfield, CT; 800-374-6738, 203-740-2400; fax, 203-775-5634.

Circle 495 on reader service card

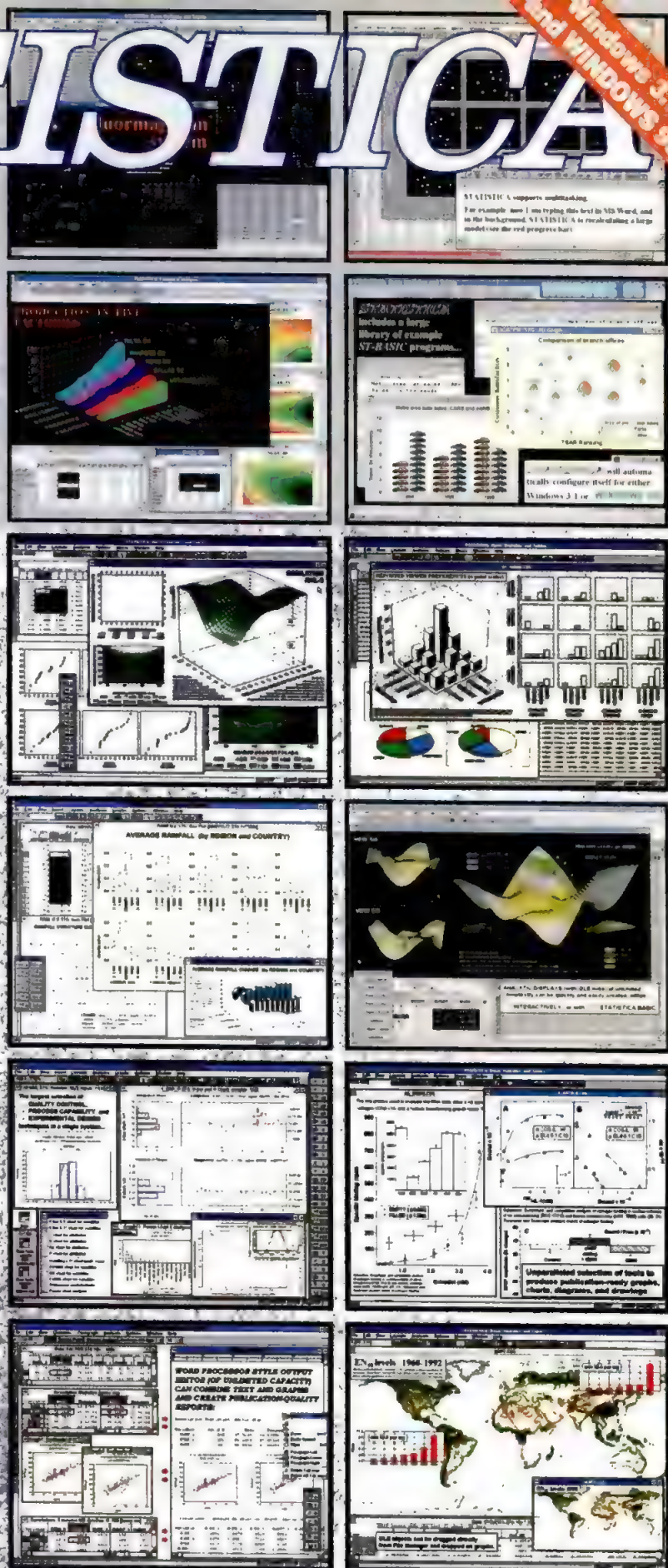


From December 11 to December 15, go on-line to discuss HiJaak 95 with Beverly Bernard of Inset Systems and J.W. Olsen, a reviewer at PC Magazine. Type GO EXEC at any CompuServe prompt.

Domestic sh/h \$12 per product; 30-day money back guarantee.



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SPEAKERS

Eminent's LFT-11: Thin Speakers with Big Sound

By Bruce Brown

Eminent Technology's \$899 LFT-11 planar magnetic multimedia reference loudspeakers are audio standard setters for the discriminating multimedia user who's looking for pure sound from the PC. Designed for multimedia authors and others who

push and pull air so the same force comes out the front and rear of the speakers. This requires that they be positioned at least 3 inches from the wall. In contrast to more typical cone speakers, the planar magnetic speakers have very low distortion



THIN IS IN: Eminent Technology's LFT-11 speakers are just 1 inch thick but deliver accurate sound.

want to know exactly what they're recording, the LFT-11 will also find a home on the desks of mainstream—but affluent—audio aficionados.

Several components are included in the LFT-11 package. In addition to an 8.3- by 10.5- by 15-inch subwoofer (with a pair of 6.5-inch speakers) that sits on the floor, there is a pair of 6.3- by 9.3-inch planar speakers that are just 1 inch thick. On their stands, these satellite speakers are 10.5 inches tall. A 15-watt-per-channel Realistic Optimus STA-300 digital stereo receiver, a monitor stand, and all necessary cables complete the package. The wooden parts of the speakers and monitor stand are made of oak, a refreshing change from the de rigueur gray or black plastic cases.

Cabling is simple. Your computer's audio card connects to the CD/Aux jack on the back of the Realistic receiver. A custom cable goes from the receiver's speaker connectors to the back of the subwoofer, and the two planar speakers plug into the subwoofer. The sound quality is best if the planar speakers are about 3 feet apart. You can put them close your monitor without worrying about display-interference problems.

The thin planar magnetic speakers use matched sets of magnets to

tion and narrow sound dispersion, which limits cross talk between the speakers. By the same token, this means that they really work best for a single listener.

When you position the planar speakers approximately 30 inches from each ear and tilt them toward your left and right ears, the LFT-11 speakers are in their element. As soon as you step away from the target zone, you'll notice an immediate loss of mid- and high-range content.

The subwoofer has a higher than usual 200-Hz crossover, so that all low and some low-midrange signals come from the subwoofers, leaving the rest of the midrange and the high-range sounds to the planar speakers. The result is that the sound you hear from the LFT-11 speakers when you're sitting in the target zone is very clear but also unforgiving.

The LFT-11 system brings to the surface sounds that were either muffled or buried by other loudspeakers. You hear singers breathing on audio CDs and a high level of detail from sound ef-

fects (like the loading of a shotgun while playing DOOM II). The lack of distortion and audio coloration makes the speakers ideal for people who are recording sounds, speech, or music and want to be sure of the exact audio content of the recording.

In case \$899 is too rich for your budget and you already have a stereo receiver or amplifier (10- to 50-watt output per channel), the LFT-11 speakers are available without the Optimus receiver for \$749. At its present price, the LFT-11 system is too expensive for most personal or standard business desktop applications, but that may change if sales volume increases. For now, however, the LFT-11 speakers are good for their target market of multimedia authors and a treat for others who want to splurge to hear great sound.

Eminent LFT-11. List price: \$899. Requires: Audio card line-out or speaker jack. Eminent Technology Inc., Tallahassee, FL; 904-575-5655; fax, 904-224-5999.

Circle 406 on reader service card

Pump Up Your Sound Blaster

If you have an FM-synthesis audio card but yearn for wavetable sound, here's an upgrade board that will give you up-to-date wavetable synthesis, including the new XG-MIDI sound. Yamaha's \$249 WaveForce DB50XG Sound Daughter Board plugs into many popular sound boards via the Wave Blaster-compatible connector and delivers improved audio.

Installation is literally a snap. Just slide the daughtercard onto the audio-board connectors and plug the audio card into your computer. No extra software is required, but you do need to configure your Windows computer to the proper MIDI mapping setting.

Using Yamaha's AWM2 tone-generation technology, the WaveForce card supports 676 normal voices and 21 drum voices. An on-board 4MB ROM chip stores this acoustic cornucopia. The included CD-ROM disk has 21 pairs of audio and MIDI format songs so you can compare CD audio versions of an audio clip with XG MIDI versions of the same piece. There is

also a small library of MIDI clips that you can use in your own compositions and a demo version of Yamaha's Visual Arranger software.

The most important feature, other than the ability to program sound with more control, is the ability to hear how MIDI music sounds with the WaveForce daughtercard. Compared with

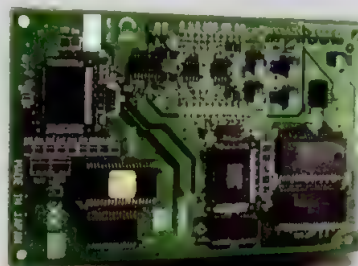
regular audio CD tracks, the MIDI version sounds much clearer and deeper.

When you can buy low-end but good-quality wavetable audio cards for about \$200, spending that much for a wavetable add-on may seem excessive, but the WaveForce isn't a pedestrian card. It sounds great, supports the newest audio standards, and is a breeze to install.—BB

Yamaha WaveForce DB50XG Sound Daughter

Board. List price: \$249. Requires: Sound Blaster 16 or compatible audio board with Wave Blaster expansion port. Yamaha Corp. of America, Buena Park, CA; 800-823-6414, ext. 99; 714-522-9011; fax, 714-228-3913.

Circle 409 on reader service card



RIDE THE WAVE: Yamaha's WaveForce DB50XG adds wavetable abilities to many popular audio cards.

BACKUP SOFTWARE

Arcada: Standalone Backup on Anything but Floppy Disks

By David Haskin

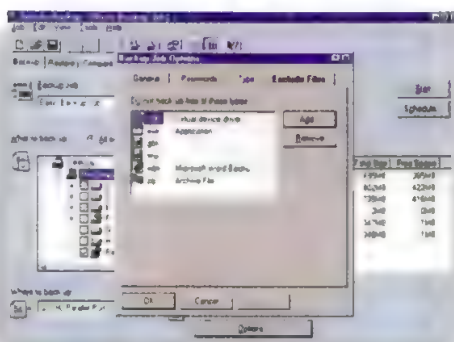
Aimed at standalone PC users, Arcada Backup for Windows 95 makes backing up and restoring files simple, but it isn't for everybody. The \$99 system is moderately flexible and powerful but it only works with tape devices and not with floppy disks, which are more common.

You create backup sets and select files to restore by clicking on folders, subfolders, or specific files in Arcada Backup's Explorer-like interface. A big help is that Arcada Backup includes Registry information at the bottom of the drive list; click on it and the program backs up or restores this crucial Windows 95 element.

To simplify the process, Arcada Backup has wizards to walk you through backing up and restoring data. The program supports long filenames and operates well as a background task. On our 90-MHz Pentium test-bed with 16MB of RAM, periodic scheduled backups caused little disruption while we worked within other applications.

Arcada shields users from many of the more complicated aspects of the program's everyday operation. For example, you can choose to compress backed-up data, but there are no settings to specify the compression method or level. Instead, Arcada Backup monitors how quickly your system feeds it data and automatically applies the maximum compression possible. During our evaluation, we achieved compression ratios ranging from 1.8:1 to 2.5:1, depending on the types of the files being backed up.

The program's backup automation is rudimentary, however. If you schedule an automatic backup, Arcada Backup alters its entry in the Registry so that the entry loads when you boot up. The program then starts the backup at the time you specified. On our tests, though, Arcada Backup didn't always remove the listing from the Registry after we canceled automatic back-



YOUR CHOICE: Arcada Backup gives the user a variety of ways to choose what to back up.

ups and the program continued to load itself automatically.

Although Arcada Backup

laudably suppresses error messages during automated backups, it doesn't notify you afterward if errors occurred. Rather, you must examine a log file for any errors. Though you can choose files to exclude from backup sets, you can't specify files to include or make selections based on modification date or attributes. Another minor gripe is that the program doesn't unload itself when it fin-

ishes a backup session.

Arcada Backup's inability to work with floppy disk drives is a strange omission for an archiving program aimed at standalone users. It does, however, support about 200 different tape drives and successfully detected our Iomega QIC-80 parallel-port device.

As a first attempt at targeting the desktop market, Arcada Backup for Windows 95 has some flaws and omissions. But if you have a tape-backup device and basic backup needs, it is simple and reasonably powerful.

Arcada Backup for Windows 95. List price: \$99. Requires: 8MB RAM, 2MB hard disk space, Microsoft Windows 95. Arcada Software Inc., Lake Mary, FL; 800-327-2232, 407-333-7500; fax, 407-333-7740.

Circle 493 on reader service card

VIDEO

Ulead MPEG Converter Slowly Compresses Video

By Jan Ozer

Priced at \$299, Ulead Systems' MPEG Converter is one of the least expensive software MPEG-compression options around. Unfortunately, though the program has some strong points—most notably its efficient and intuitive interface—Ulead's first MPEG-conversion program is hampered by poor file and playback compatibility.

The MPEG Converter transfers Video for Windows .AVI files into MPEG files and is compatible with all Video for Windows capture cards, such as Intel's Smart Video Recorder Pro. There are a variety of options, including frame resolution, data rate, frame rate, audio channels, and audio-sampling rate. The MPEG Converter goes both ways, converting .AVI files to MPEG format and back to .AVI format again. You can also convert Windows audio files (.WAV) to MPEG audio files (.MP2) and vice versa.

The program's interface is very intuitive and has been designed to enhance batch operation, though in some cases it's lacking in features and flexibility. Unlike with similar programs, the user can't adjust the internal MPEG frame sequence (I, B, and P frames) to match video content, which can have a large impact on



GET IT RIGHT: The MPEG Converter supports a wide selection of compression criteria.

video quality. Other common features not offered by the MPEG Converter include NTSC and PAL compression presets and the ability to merge separate .WAV and .AVI files into one MPEG file.

On the whole, the MPEG Converter produced good-quality video, about on a par with other software MPEG compres-

sors such as Xing. On our Pentium/60 test-bed, four 20-second video clips took 3 hours 45 minutes to compress to MPEG files, which translates to a whopping 2 hours 50 minutes for each minute of raw video.

There were significant playback-compatibility problems as well. We tested the compressed files with two playback devices: CompCore Multimedia's software-only MPEG player and ELSA's Motion MPEG player, a PCI-based hardware solution. The CompCore unit failed to play 5 of the 21 test files, and the ELSA unit failed to play 10 of the 21 files.

Though no MPEG compressor provides 100-percent compatibility, Ulead's first-generation MPEG-compression program is clearly not well suited at this time for producing commercial titles. It could work well in limited distribution settings, however, where files can be thoroughly tested with all intended playback devices.

Ulead MPEG Converter. List price: \$299. Requires: 8MB RAM, 4MB hard disk space, Microsoft Windows 3.1 or later. Ulead Systems, Torrance, CA; 800-858-5323, 310-523-9393; fax, 310-523-9399.

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- Flash BIOS for easy upgrade
- Full plug-and-play capability
- Complete Windows 95 compatibility
- Preloaded Desktop Management Interface (DMI)
- EPA Energy Star certified
- Free three-year limited warranty for parts and labor²

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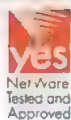
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A picture is worth a thousand words. Especially when your monitor shows all of them.

The ADI MicroScan 17X monitor is a concise answer to the problem of viewing oversized documents. It easily pivots from landscape to portrait mode—just click on the portrait driver icon, rotate the monitor and press the degauss button. You can view an entire legal or A4 page without scrolling or printing—ideal when you need to edit a lot of text. It also accommodates oversized spreadsheets, databases, and dozens of other applications.

Super-Large Display

The MicroScan 17X is like getting a 21" display for the price of a 17" monitor. Its vertical viewing area in portrait mode is larger than any 17" or even 21" monitor on the market. And to make a long story short, it saves you countless hours of scrolling through oversized documents.

High-Quality Feature Set

The MicroScan 17X has lots of other things to write home about. Like a 17" CRT display with a 16" diagonal viewing area, 1024 x 768 resolution, flicker-free 76Hz performance, .28mm dot pitch, digital and microprocessor controls, even Plug-n-Play compatibility. And it's all backed by a three-year warranty. This is a feature set you won't find in competitively priced products. And since ADI builds monitors for leading PC companies worldwide, you know you're making a quality investment for the long haul. Get the full story on the MicroScan 17X—call 1-800-228-0530 for your nearest ADI dealer.



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CIRCLE 226 ON READER SERVICE CARD

New & Improved

NEWS OF ANNOUNCED PRODUCTS AND UPGRADES

By Melissa J. Perenson

Reference Assistant

A bargain at just \$49.95, Compton's Reference Collection 1996 Edition, from **Compton's NewMedia**, is the perfect complement to any home or office PC user's desk. This CD-ROM compendium couples *Compton's Concise Encyclopedia* with ten other business and reference works that together form a formidable personal library. Among the references included are *The Macmillan Dictionary of Quotations*; *The Elements of Style*, the classic style guide whose guidelines on grammar, word usage,



INFORMATION OVERLOAD: Conduct searches across Compton's Reference Collection's 11 sources.

and writing style was required reading in college; *The Elements of Business Writing*; J.K. Lasser's *Legal and Corporation Forms for the Smaller Business*, which includes over 200 templates; and the *Webster's New World Dictionary* and *New World Thesaurus*. A streamlined interface and powerful search engine make it easy to navigate amongst the cross-referenced references.

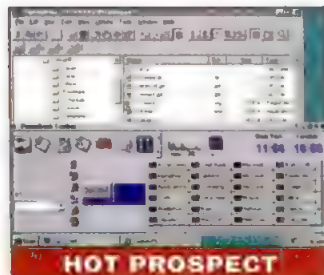
Compton's Reference Collection 1996 Edition. List price: \$49.95. Compton's NewMedia Inc., Carlsbad, CA; 800-261-6109, 619-929-2500. Circle 504 on reader service card

Pocket Change

There's no reason not to keep track of your finances while you're on the run or on the road, now that **Intuit's** ubiquitous Quicken is available for Franklin Electronic Publisher's Bookman platform of hand-held electronic books. Pocket Quicken on Bookman packs an easy-to-use QWERTY keyboard, 128K of flash memory, and a comfortably readable if compact LCD screen into a \$100 device that weighs a mere 4.5 ounces and is not



PALM PERFECTION: Pocket Quicken.



PowerDesk: A Powerful Utility

Now that you've switched to Windows 95, you're probably getting nostalgic for some of the file management functionality of Windows 3.1. Well, **MicroHelp's** \$40 PowerDesk goes a long way toward making the new Windows 95 desktop work with you—not against you.

PowerDesk is a utility on the order of Starfish Software's Dashboard but has an even greater degree of customization. It's a flexibility that goes beyond just providing an alternative means of navigating your system.

PowerDesk works in concert with Windows 95, offering features such as Autohide, instant access to Windows 95's shutdown and system controls, integration with the Taskbar, and a Start-button enhancement that provides easy-to-manuever, single-layer pop-up menus (in contrast to Windows 95's multilayered approach).

You can view multiple clocks showing different time zones. You can also resize the PowerDesk toolbar and opt to have multiple-application QuickLaunch pads within the same toolbar for single-click access to your programs.

Die-hard DOS users who miss their C: prompt will relish the fact that PowerDesk includes the DOS command line in its toolbar and its Explorer Plus enhancement. Explorer Plus provides such conveniences as the ability to view multiple drives simultaneously under a single instance of Explorer and the automatic decompression of zipped files when the files are dragged-and-dropped.

PowerDesk. Estimated street price: \$40. MicroHelp Inc., Marietta, GA; 800-777-3322, 770-516-0899; fax, 770-516-1099.

Circle 440 on reader service card

much larger than an index card. The cable and software necessary to upload your data to your desktop's Quicken are included.

Pocket Quicken on Bookman. Estimated street price: \$100. Intuit, Menlo Park, CA; 800-243-4650, extension 810288, 415-833-6436; fax, 415-322-0573.

Circle 410 on reader service card

A Monitor's Tilted View

No more craning your neck or imagining what a page would look like if you were to view it in its entirety. **ADI Systems'** \$860 MicroScan 17X lets you turn your display 180 degrees thanks to a pivoting screen that shifts from horizontal to vertical with the touch of your fingers. The 17-inch monitor's vertical screen has a 320-millimeter vertical capacity, providing a viewing area large enough to read a letter- or legal-size document. You tog-



LET'S PIVOT: The ADI MicroScan 17X lets you turn your display on its head.

gle between orientations using hotkeys. The unit has a dot pitch of 0.28 millimeters and supports resolutions up to 1,270-by-1,024 at 60 Hz.

MicroScan 17X. Estimated street price: \$860. ADI Systems Inc., San Jose, CA; 800-228-0530, 408-944-0100; fax, 408-944-0300.

Circle 415 on reader service card

Now Showing on Your PC

Add full-screen, full-motion MPEG video functionality to your PC with **Vision Interactive's** \$430 MPEG video-upgrade kits. The ESPN MPEG Sports Pack and the Orion MPEG Movie Pack each bundle the Ace Movie Master 24-bit MPEG board with a selection of MPEG-ready game, instructional, and movie titles. In many cases, Vision is reencoding existing content titles to run under full-screen MPEG. The eight interactive ESPN multimedia titles and eight full-motion ESPN videos in the ESPN package are examples of this

New & Improved

technology. Installation is as simple as popping in the card; the included software does the rest.

ESPN MPEG Sports Pack. List price: \$430. Vision Interactive Publishing, Irvine, CA; 714-833-1822; fax, 714-833-3620.

Circle 431 on reader service card

It Takes a Steady Thumb

Trackball performance tends to suffer from the dirt and dust in the air and even from the oils on your hands. **Logitech's \$100 TrackMan Marble** uses neural-network technology that senses track-

ball movement to help eliminate those problems. The sleek trackball is designed to be controlled by your thumb and to fit the shape of your hand.

Kensington Micro-ware's \$100 Expert Mouse 5.0 Programmable Trackball offers a more traditional approach to trackballs. In addition to upgraded software, the trackball now includes four programmable buttons and a tapered, comfortable design.

Logitech TrackMan Marble. Estimated street price: \$100. Logitech Inc., Fremont, CA; 800-231-7717, 510-795-8500; fax, 510-792-8901.

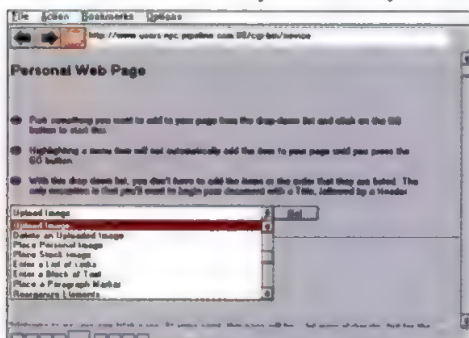
Circle 425 on reader service card

Kensington Expert Mouse 5.0 Programmable Trackball. Estimated street price: \$100. Kensington Microware Ltd., San Mateo, CA; 800-535-4242, 415-572-2700; fax, 415-572-9675.

Circle 426 on reader service card

A Dose of Web Creativity

Performance Systems International has upgraded the software for accessing its Internet services, Pipeline New York and Pipeline USA. PSI is now Winsock 1.1-compliant, so that you can use any World-Wide Web browser you choose. Also new is WebMaker, an interactive personal Web-page creator that constructs Web pages while you're connected on-line. For \$5 per month beyond the



A PAGE OF YOUR OWN: Pipeline 3.3's WebMaker makes it easy to design your own Web page.

HARDWARE BRIEFS

Conner Peripherals' \$329 TapeStor 3200 has a maximum compressed capacity of 3.2GB when using TR-3 Travan tapes. The tape drive can handle 1.6GB of compressed capacity with the TR-2 cartridge and 1.7GB with the QIC-Wide Media. A TR-3 tape is included with the system. 800-553-7070, 714-641-1230.

At the other end of the backup spectrum is **Pinnacle Micro's Apex 4.6 Gigabyte** drive, a \$1,500 5.25-inch rewritable optical drive for use with all Microsoft Windows and Macintosh systems. According to Pinnacle, the drive, which includes one 4.6GB disk, achieves a 6-megabyte-per-second data-transfer rate. 800-553-7070, 714-789-3000.

And falling somewhere in between the aforementioned products is **MOST's Jupiter 1**, a \$2,795 2.6GB 5.25-inch magneto-optical drive that provides backward compatibility with 1.3GB and 650MB cartridges. 800-944-6232, 714-898-9400.

Zenith Data Systems' Z-Power line of PowerPC-based servers is available in monoprocessor and Escala symmetrical-multiprocessor models. The machines start at \$4,400 and can run either Windows NT 3.51 or AIX 4.1. 800-533-0031, 708-808-5000.

Sony's \$49.95 DR-50PC computer headphones provide clear sound reproduction and the ability to make recordings through their flexible boom microphone. 800-222-7669.

Dell Computer Corp.'s Dell Latitude LX, which starts at \$1,999 for a base model, includes either a DX4/75 or a DX4/100 CPU, 4MB of RAM, 128K of external cache, a removable 3.5-inch floppy disk drive that's swappable for a second nickel hydride battery, and a choice of removable 420MB, 524MB, and 819MB IDE hard disks. The 6.2-pound machine has a 10.4-inch, 640-by-480 passive-matrix color display and one Type III PC Card slot. 800-289-3355, Web, <http://www.dell.com>.

If your current tape drive doesn't support Travan tapes and yet you need more storage space, try **Gigatek Memory Systems' hardware and software solution**, More Megs! Priced at \$39.95, the DC2120EX QIC-80 800MB cartridge is the first in Gigatek's EX Series of higher-capacity QIC-80 minicartridges. The package includes NovaBack for Windows software. 800-669-1989, 619-438-9010.

basic \$19.95 unlimited-usage monthly fee, you get 320KB of space and half a megabyte of bandwidth to maintain your own Web pages. The forms-based interface makes it simple for beginners to craft a Web page without knowing the first thing about HTML; advanced users can import HTML code. Images can easily be added via e-mail, and there's a one-step option for registering your Web page at popular Web indexes.

Pipeline 3.3. List price: \$5 per month, first two months free. Performance Systems International, Herndon, VA; 800-453-7473; Web, <http://www.usa.pipeline.com>; e-mail, info@usa.pipeline.com.

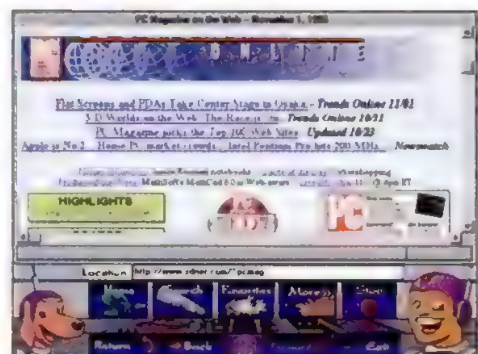
Circle 421 on reader service card

Family Time On-Line

As the holiday season approaches, here are a few ways to let your kids safely enjoy the Internet.

ConnectSoft's \$39.95 KidWeb is a World-Wide Web browser specifically for children of 8 to 12. The browser has integrated parental control, large easy-to-navigate buttons, and a host of friendly animated characters that help kids cruise the Internet. Also in ConnectSoft's line of family-oriented Internet software is the forthcoming Internet Connection—Family Edition. Geared toward teenagers and adults, this package includes a Web browser, newsreader, TCP/IP stack, one-step Internet access, and parental controls.

CompuServe Internet Division's \$49.95 Internet



SAFE HAVEN: Families can have fun safely surfing the Web with ConnectSoft's KidWeb.

in a Box for Kids combines SPRY's Mosaic browser with SurfWatch Software Corp.'s SurfWatch so that parents can keep tabs on their children's on-line activities. There's also a simplified version of e-mail, a family video about the Internet, and subscriber access to FreeZone, a Web community for children with chat rooms, shopping, a home-page builder, and interactive games. **ConnectSoft KidWeb.** List price: \$39.95. ConnectSoft Inc., Bellevue, WA; 800-234-9497; Web, <http://www.connectsoft.com>.

Circle 429 on reader service card

Internet In A Box for Kids. List price: \$49.95. CompuServe Internet Division, Seattle, WA; 800-557-9614; Web, <http://www.compuserve.com>.

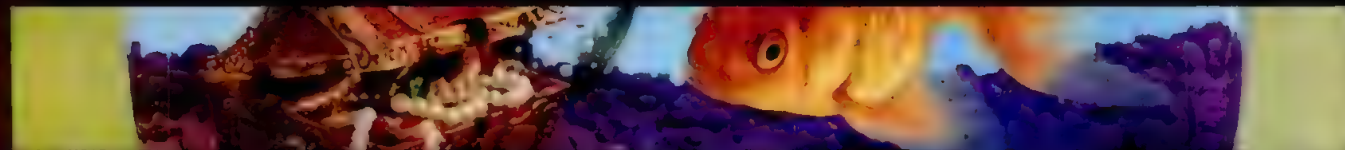
Circle 430 on reader service card



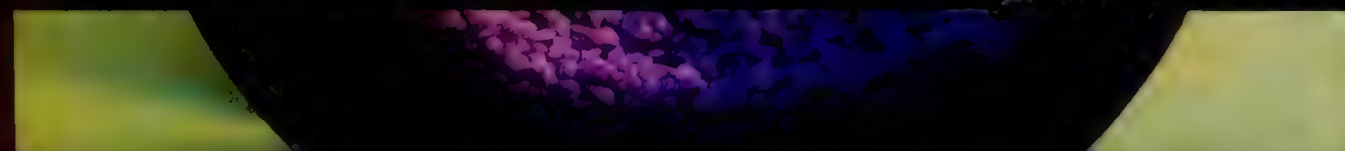
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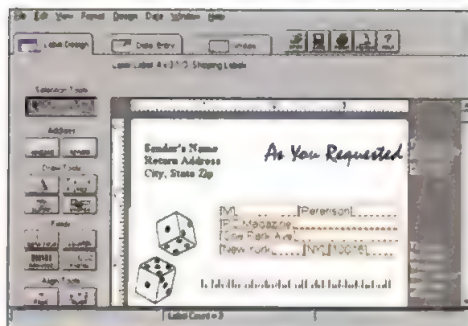
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If you're determined to do things for yourself, then **MySoftware Co.**'s \$59.95 **MyDeluxeLabelDesigner** is for you. The easiest and most flexible



DESIGN ON THE FLY: MyDeluxeLabelDesigner lets you custom design your labels.

means of creating labels, LabelDesigner includes ODBC support, custom labels, and an assortment of alignment and drawing tools. The CD-ROM includes a copy of MyBusinessCards, another of the company's products. Another MySoftware release, the \$79 **MyAdvancedBrochures 95**, has come a long way in developing its functionality. The Windows 95 version adds a streamlined interface, OLE 2.0, drag-and-drop graphics, and a mail-merge wizard. There's also improved control of text flow, alignment, and line spacing.

MyDeluxeLabelDesigner. List price: \$59.95. **MyAdvancedBrochures 95.** List price: \$79. MySoftware Co., Palo Alto, CA; 800-325-3500, 415-473-3600; fax, 415-325-0873.

Circle 418 on reader service card

OS/2 at Work and Play

Stardock Systems' OS/2 Essentials is a \$39.95 OS/2 utility that fills in some of the incomplete areas of OS/2. There's a screen saver that supports DOS and Windows, an improved file manager, a taskbar, file security, and more.

But life's not all work. Have some fun with **IBM Corp.**'s \$49.95 **Family FunPak** for OS/2 Warp. This edutainment CD-ROM is packed with ten OS/2 titles and two DOS/Windows titles that cover the spectrum of games, reference, and personal productivity. The titles include American Heritage Dictionary, Concise Edition; In Charge at Home; OS/2 Black Jack; and SimCity Classic Limited. **OS/2 Essentials.** List price: \$39.95. **Stardock Systems,** Canton, MI; 313-453-0328; Web, <http://oeonline.com/~stardock/>

Circle 427 on reader service card

IBM Family FunPak for OS/2 Warp. List price: \$49.95. IBM Corp., Armonk, NY; 800-426-2968.

Circle 428 on reader service card

SOFTWARE BRIEFS

'Tis the season for the holidays, so live up your posters and documents with **ClickArt's** \$19.95 clip-art package, **Bundle Up for The Holidays**. There are over 400 festive color images for the season, from a traditional Christmas tree to a Hanukkah menorah and a Thanksgiving turkey. 800-986-2537, 415-962-0195.

Joining the fray of street-atlas products is **Microsoft Corp.**'s **Automap Streets**, Version 4.0. This \$69 two-CD-ROM set provides Etak digital street maps of the 48 contiguous states and Hawaii. Searching is made easier by integration with Automap Atlas. 800-426-9400, 206-882-8080.

Tired of downloading files off the Internet and having to struggle to decompress them? Net surfers, take heart: The \$39.95 **NetZIP** for Windows, from **Software Builders International**, takes care of decompression by opening and managing zip and TAR files as well as other file formats. NetZip works within File Manager to let users drag-and-drop files, open many zip files simultaneously, and create self-extracting files with ease. 800-432-0025.

Datawatch Corp.'s \$499 **Monarch** for Windows, Version 2.0, upgrades this data access and analysis tool to include the ability to extract data from loosely formatted reports and free-form text and the ability to open multiple instances of any report. 800-445-3311, 508-988-9700.

Numera Software's Visual CADD, Version 2.0, is a \$995 programmable and flexible design, engineering, and drafting package for Windows 95. New features include increased speed, dynamic frame reference, context-sensitive right-mouse menus, and wizards. 800-956-2233.

The not-for-profit sector gains an ally in **Micro Information Products'** MIP NonProfit Series for Windows. The first module available is the general ledger module, with accounts payable, budget, and payroll modules soon to follow. The modules will range in price from \$1,000 to \$1,500. 800-647-3863.

The second issue of **Marinex Multimedia's** \$9.95 CD-ROM entertainment magazine **Trouble & Attitude** has features that live up to its name. The disk's editorial content includes a feature on the cigar craze that's sweeping the country and a lead story on "The Women of James Bond." The latter includes audio interviews with the latest Bond women and clips from five Bond films, including the new film *GoldenEye*. 212-334-6700.

Freedom to Wander

Stay linked to your home base with **Funk Software's** **WanderLink 2.0**. This remote-user pack, designed for use with the WanderLink 2.0 server, provides TCP/IP support, NetWare Client VLM 1.2, and Proxy 1.5. Funk's remote-control software that gives you a smaller TSR (one as low as 9K) and improved performance for WanderLink connections. Version 2.0 of the WanderLink server also now supports the TCP/IP protocol as well as the Password Authentication Protocol for connections from non-WanderLink clients.

WanderLink 2.0. List price: \$795 for 4-user license. **Funk Software Inc.,** Cambridge, MA; 800-828-4146, 617-497-6339; fax, 617-547-1031.

Circle 419 on reader service card

There's No Excuse Now For Not Using Backup

Iomega Corp. and **Micro Solutions** have eliminated the two most commonly heard excuses for not using a tape-backup drive—cost and ease of use.

The \$169.95 **Micro Solutions Backpack 800TD** represents a complete physical and cosmetic makeover from previous Micro Solutions tape drives. This parallel-port drive primarily supports QIC-80 and Travan TR-1 tapes and includes a utility that eases the chore of backing up your system. When using Travan TR-1 tapes, the 800TD can store up to 800MB of compressed data.

Iomega's **Ditto Easy 800**, which has a similarly sleek design, also supports the QIC-80, Travan TR-1, and other popular QIC tape formats for a maximum drive capacity of 800MB (with Travan tapes). The quiet \$150 parallel-port drive complements the appearance—and purpose—of Iomega's Zip and Jaz drives.

The Ditto includes Iomega's software utility, which allows you to back up your drive with a single click while still continuing to work on your machine.

Micro Solutions Backpack 800TD. List price: \$169.95. **Micro Solutions Inc.,** DeKalb, IL; 800-890-7227, 815-756-3411; fax, 815-756-2928.

Circle 435 on reader service card

Iomega Ditto Easy 800. Estimated street price: \$150. **Iomega Corp.,** Roy, UT; 800-697-8833, 801-778-1000; fax, 801-778-5763.

Circle 436 on reader service card



PLAY IT SAFE: Tape backup has never been easier.

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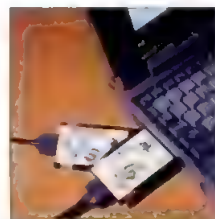
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Read Only

REVIEWS OF THE LATEST BOOKS FOR THE PC USER

Edited by Tin Albano

A Behind-the-Screen Look at How Microsoft Does Things

BY DANIEL GROTTA
AND SALLY WIENER GROTTA

Not long before Microsoft completed its wildly successful multimedia CD-ROM encyclopedia, Encarta, a small team of designers, developers, artists, and editors, began work on an ambitious, cutting-edge interactive multimedia CD-ROM for children, code-named Sendak.

Author Fred Moody convinced Microsoft to allow him to document the entire project. In fact, they gave him unprecedented total access to everything and everyone involved with Sendak.

Moody's *I Sing The Body Electronic* brilliantly chronicles the tortuous process of creating and completing a single Microsoft product, now called Explorapedia. The book is more than just another behind-the-scenes, fly-on-the-wall piece of journalism. Moody's experiences and insights go to the heart of what makes Microsoft the most successful software company in history and Bill Gates the richest man in America.

I Sing The Body Electronic captures Microsoft's high-energy, crisis-driven, competitive,

and often adversarial atmosphere that apparently is the hallmark of virtually all the company's projects. We become privy to Microsoft's inner secrets: the friction between an army of well-paid independent contractors with no status or security and a small cadre of employees with health plans and stock options that make many of them millionaires before age 30; the hostility between designers who create wonderful features and the pro-

grammers who shoot them down by saying that they're impossible or too time-consuming to implement; the constant design-change demands, even after code has been written; and the attempt to maintain friendships and even sanity as egos clash, tempers flare, and promises are broken.

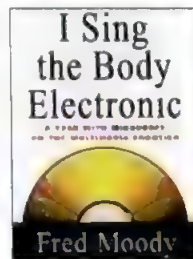
The only disappointment is Moody's coverage of the final stages of the project. He apparently ran out of time and had to condense the last few months into pages rather than chapters.

As narrative, *I Sing The Body*

Electronic will inevitably and favorably be compared with Tracy Kidder's Pulitzer Prize-winning *The Soul of a New Machine*. It's a well-written story with a wealth of detail and depth that leaves the reader feeling he not only knows each member of the Sendak team personally but also has a much better understanding of how and why Microsoft succeeds as it does.

I Sing The Body Electronic, by Fred Moody, \$24.95. Viking Penguin, 800-526-0275; ISBN: 0-670-84875-1.

Circle 488 on reader service card



Coming to Terms with Computer Crime

BY DON WILLMOTT

Someday in the near future, a judge will ask a hacker why he breaks into computer networks, and the hacker, evoking the ghost of Willie Sutton, will answer, "Because that's where the data is."

If you tend to be a paranoid type of person, *Computer Crime: A Crimefighter's Handbook*, by David Icove, Karl Seger, and William VonStorch, will keep you up at night pondering the

incredible number of computer crimes that people can commit and the difficulties involved in stopping them.

The book, split into sections

that deal with defining computer crimes, preventing them, and handling them, is loaded with fascinating facts. When you stop to think about it, the number of different types of crime is alarming: sabotage, revenge, vandalism, theft, eavesdropping, even "data diddling." For each type of attack, the book suggests preventive measures and strategies, all in common-sense style and plain English.

You'll feel like an FBI agent as you read the personality profiles of different types of computer criminals. Hackers, crackers, and vandals are all psychoanalyzed, and interesting charts of "vulnerabilities" and

"countermeasures" will help you make plans to keep your organization safe from outside attack. The book includes discussions of everything from choosing locks and keys to interviewing personnel, setting up "concentric circles" of defense perimeters, and forming a crisis-management team to handle the fallout from a

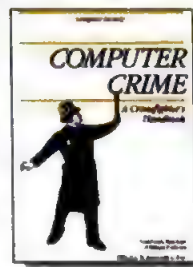
successful computer crime. There's even an entire page devoted to all the passwords you should never use.

Almost one-third of the book is given over to the actual text of federal and state laws used to prosecute computer crime. This section is meant not to be read but to be used instead as a reference.

It may not necessarily be you, but someone in your organization should be up to speed on the kind of information that *Computer Crime* provides.

Computer Crime: A Crimefighter's Handbook. O'Reilly and Associates Inc., \$24.95; 800-998-9938; ISBN: 1-56592-086-4.

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want to feel eighties, do you? \$9.95, Random House Electronic Publishing; 800-793-2665; ISBN: 0-679-76230-2.

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CIRCLE 286 ON READER SERVICE CARD

Reviewing the Web

Just as we're becoming comfortable looking at the World-Wide Web—with commercial and personal home pages popping up faster than corn kernels in a microwave—as the publishing medium of the future, a whole new generation of browsers

promises to change our view. These new browsers will, of course, provide enhanced tools for publishing information on the Web. That's great, but more important, these browsers will furnish us with tools that will turn the Internet into the next great application development platform.

These tools include things such as languages that let you create scripts to run on the client or server and new application programming interfaces (APIs), so programs can be written specifically for Web browsers. There will also be new database access tools and new tools for security—including those that can handle electronic transactions.

These browser enhancements will change our perception of the Web in this way: Not only will we look towards the Web as a means for publishing information, we will also see it as a platform where the great promise of client/server computing can truly flourish.

Let's look at some of the most interesting browser developments that are available for downloading today.

Not surprisingly Netscape, whose Navigator is by far the leading Web browser, is providing some of the most important innovations. A beta version of Netscape's latest browser, Navigator 2.0, is now available for downloading (www.netscape.com).

Navigator 2.0's most important new feature is its support for Java, Sun Microsystems' object-oriented language designed specifically for the Web. Java, based on C++ with extensions for RSA-based security, is designed so that you can write applications that reside on the server but execute within the browser on any operating system.

This is a big change. Today's browser is essentially just a viewer for things happening on a server. While we have seen some interesting applications developed with this setup, they have mostly used common gateway interface (CGI) scripts. For instance, nearly all the on-line order systems you see today use CGI scripts, as does ZD Net's Personal View (which lets you see a personalized view of computer news).

Java is different because it's designed for a cross-platform, client/server world. Java applets reside within HTML pages but can actually execute on your local machine within your browser. This means a single applet can be designed to run on any platform—Macintosh, Unix, Windows—that runs a Java-capable browser. Netscape's Navigator 2.0 is available for both Windows and Macintosh platforms. Sun's HotJava browser can run on Sun's own Solaris OS as well as Windows 95 and Windows NT (<http://java.sun.com>).

For those who find Java too daunting, Navigator 2.0 will also include a slimmed-down, easier-to-use variant called the Netscape Scripting Language. This is designed for very simple scripts that any HTML composer can create.

If Java is successful, it will position the Internet as its own platform, independent of the operating system running on your hardware. In fact, the way we look at operating systems and platforms will change entirely: Netscape Navigator (because it implements Java) becomes the operating system, the Internet—World-Wide Web—becomes the platform, and Java becomes the de facto standard for delivering code and objects. We've already seen the first preliminary applications. @home, for example, is a personal finance package entirely on the Web.

Netscape built several other things into Navigator 2.0 that bring it closer to becoming an operating system. Navigator's new APIs will allow for in-line viewers (also called plug-ins), letting developers create applications that can run within a browser and be embedded within pages. A number of applications are already being prepared, including versions of Macromind's Director and Adobe's Acrobat as well as players for Apple's QuickTime and Intel's Indeo.

The ability to run these—as well as yet-to-be-developed—applications on the Web give it the power to display multimedia titles, making the Web a platform that can present information as impressively as your PC.

The Web's publishing prowess has also been augmented with Frames, another new feature of Navigator 2.0. Frames lets a page designer set up different regions of the screen as



NEW BROWSERS
from Netscape
and Microsoft
will change
the way we look
at the World-
Wide Web.

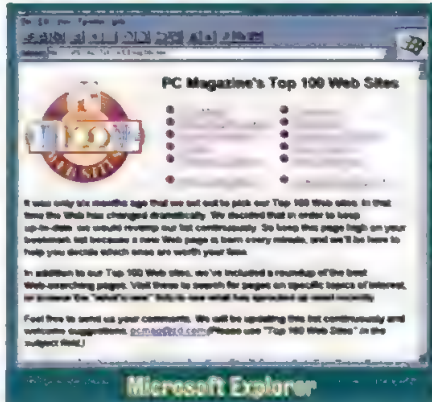
MICHAEL J. MILLER

individual windows that can be either set to scroll or to stay the same. This allows for a variety of new applications, such as showing multimedia information in multiple windows or advertisements that float on top of copy.

For instance, we're now experimenting with Navigator 2.0 on our Web site (www.pcmag.com). If you check out our latest update of the PC Magazine Top 100 Web Sites list using Netscape 2.0, you'll be able to keep the list on-screen while you look at the sites we've selected. If you have a different browser, the list still works, but once you click on a site, the list disappears, as usual.

Navigator 2.0 also includes built-in e-mail and news-reader features as well as security and speed enhancements. For an extra cost, a Gold version (which you will not be able to download) is available. It will add graphical features for creating HTML pages, including forms, in-line viewers, and live embedded objects.

Microsoft is furiously playing a game of catch-up. Its latest browser, Internet Explorer 2.0, is available for downloading (



.microsoft.com), and has some of the same features of Navigator 2.0, but isn't as robust.

Internet Explorer 2.0 supports a number of HTML extensions, including tables, which were popularized by earlier versions of Netscape Navigator. Like Navigator, Explorer also supports in-line applications, particularly AVI video files and Real Audio sound files. Explorer plans to support Virtual Reality Markup Language (VRML) pages, with 3-D support based on the Reality Lab Engine.

Microsoft has been ahead in supporting Windows standards—such as shortcuts and OLE—but Netscape is catching up. And one would expect Microsoft to move several of its Windows standards—its OCX controls and Visual Basic scripting language, for example—to the Internet, in addition to on-line tools such as Blackbird.

Both Microsoft and Netscape support SSL for security, and both talk about developing open standards for electronic payment. But Microsoft and Visa are now talking about what they call Secure Transaction Technology (STT), while Netscape and MasterCard are supporting an alternative called Secure Courier.

There are other browsers available with their own unique features. We'll have to wait and see which one becomes the standard. □

GUIDE TO ELECTRONIC EDITIONS

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In a PC Magazine first, the 12th Annual PC Magazine Technical Excellence Awards ceremony has been created as a 3-dimensional on-line virtual world on the World-Wide Web. You take the form of an "avatar" (an on-screen representation of yourself), wander through the halls of the awards site, check out the finalists and winners of our Technical Excellence Awards, and trade opinions and bons mots with other visitors in the virtual hall. This 3-D world was designed by Worlds Inc., a builder of on-line multiuser environments that connect people across the world.

If you're reading this before November 13, 1995, you can join the awards ceremony live on that date at 8 pm Pacific Standard Time (the ceremony is held at Comdex in Las Vegas, NV). After this date, you can visit the award site until September 1, 1996.

In order to visit the Technical Excellence awards, you'll need Internet access. You'll also need to download the client software, follow the connection instructions, and familiarize yourself with any applicable Worlds Inc. charges. You can do so from the following services:

World-Wide Web <http://www.pcmag.com>

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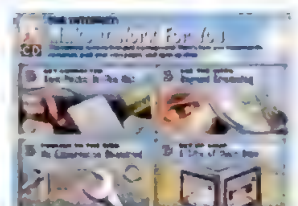
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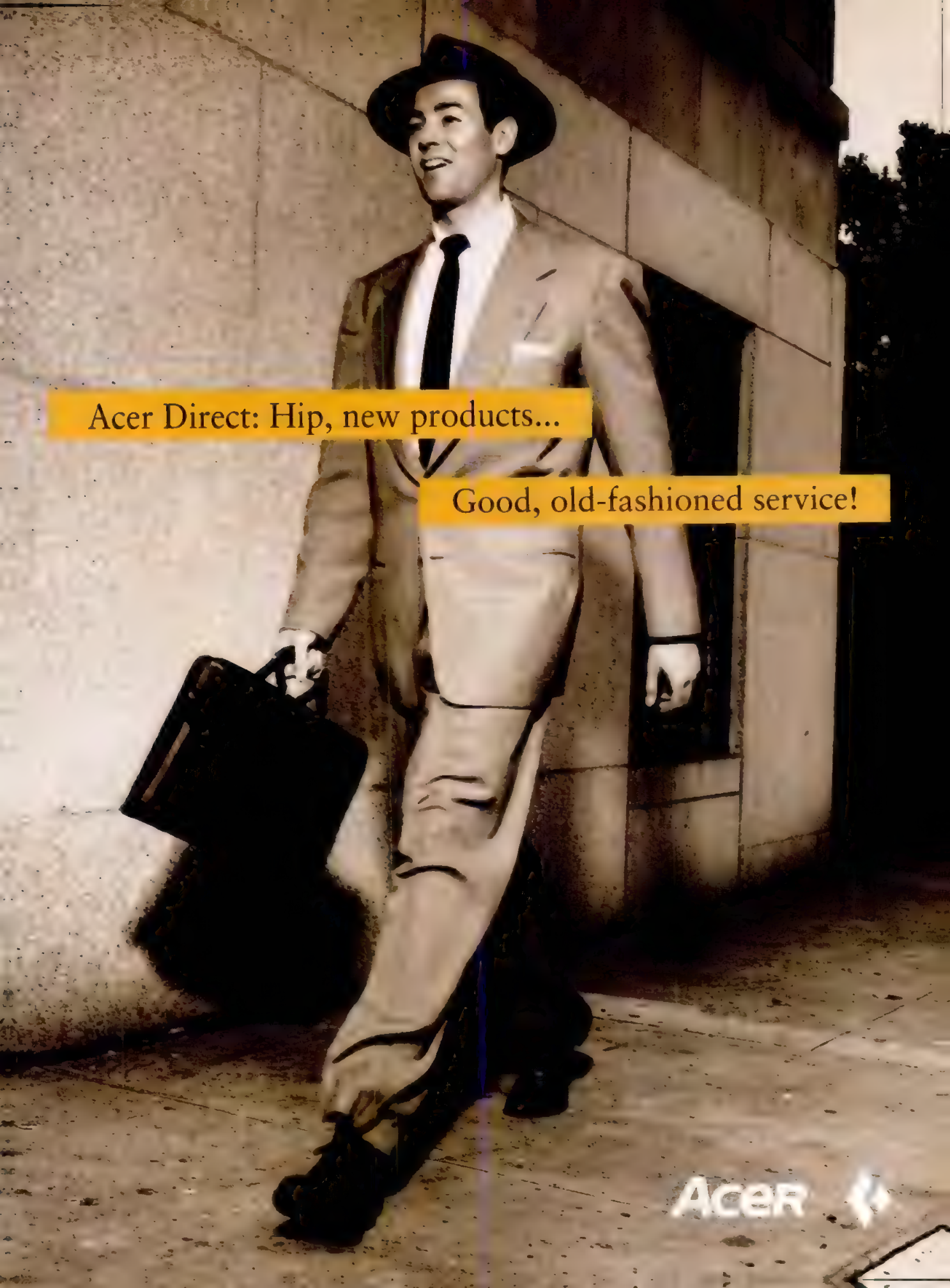
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A man in a light-colored suit, white shirt, dark tie, and a fedora-style hat is walking down a sidewalk. He is carrying a dark briefcase in his right hand. The background is a stone wall and a building corner. The overall tone is vintage and sophisticated.

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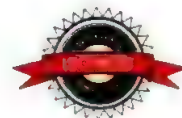
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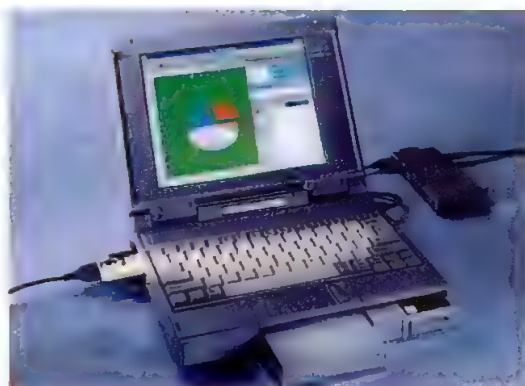


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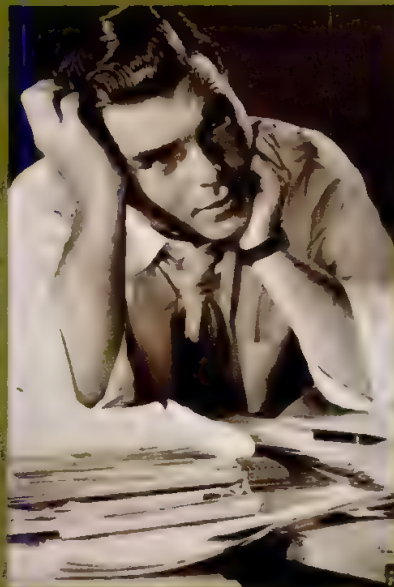
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CIRCLE 345 ON READER SERVICE CARD

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Cyrix has finally begun to ship its 6x86 chip. While Intel isn't exactly quaking in its boots, the 6x86 represents the first real alternative that system builders—and users—have had to the Pentium. We stand to reap the twin competitive benefits of lower

prices and better technology. The 6x86, known as the M1 while it was in development, is the first chip to match and even exceed the Pentium's performance at a given clock speed, while offering a full range of features. For example, unlike NexGen's chip, the 6x86 includes a floating-point unit.

Cyrix gambled on Intel's ongoing success and won. Several years ago, when Cyrix began designing the M1, it bet that the x86 instruction set would continue to dominate the marketplace. It also bet that it could reach its performance goals by refining and improving the traditional x86 execution core. On the one hand, predicting the dominance of the x86 instruction set was a no-brainer. On the other, many experts pointed out all the good reasons why the x86 instruction set and architecture had hit the wall.

The future, they said, was in flexible RISC designs that could execute their native instructions with blinding speed, so fast that they'd be able to emulate x86 instructions with at least the speed of a 486 for backward compatibility with legacy Windows and DOS applications. If you think this sounds like a PowerPC, you're right. The PowerMac is the best thing around for x86 emulation, yet it's still not good enough for industrial-strength use.

Intel also thought that RISC was the way to go and built its Pentium Pro (née P6) design around a RISC-like microarchitecture that interprets and executes x86 instructions. One advantage of a microprogrammable architecture is that you can tune the performance of the chip without extensive redesign. Intel did just that with the Pentium Pro, but optimized it for 32-bit instructions. Evidently, it believed Microsoft's hype about the speed with which we'd all migrate to 32-bit operating systems and applications. Needless to say, it hasn't happened, and most of us will be running warmed-over 16-bit code for some time to come. By contrast, Cyrix improved the performance of the entire x86 instruction set so that everything goes faster, not just the optimized instructions.

Historically, new microprocessors have had to offer at least a 20 percent increase in performance to get consumer

attention and establish a market niche. I doubt we'll see the three- and fourfold increases we saw as we moved from the 8088 to the 286 and from the 286 to the 386; all the easy gains have been made, although the designers will assure you that they weren't easy at the time. Both the Pentium

Pro (are the rest amateurs?) and the 6x86 offer that boost, but the Pentium Pro does it only for 32-bit code, while the Cyrix chip increases performance across the board.

In the past, Cyrix has taken, shall we say, poetic license in naming some of its processors, begging unwarranted comparison with faster, better chips. The 6 in this new chip's name is meant to evoke an image of sixth-generation performance, on a par with the Pentium Pro. In this case, the claim is well justified, especially given the Pentium Pro's disappointing performance with 16-bit and mixed 16- and 32-bit code, the complexity of its multichip packaging, and its expense.

Even if you don't count the Pentium Pro's lackadaisical 16-bit performance, the Cyrix chip shines in its field. The 6x86, running at 100 MHz, performs at roughly the same level as a 133-MHz Pentium and even beats it on some tests. It has already clocked some of the fastest benchmark test times our labs have ever seen. As the chip goes through die shrinks, higher levels of metallization, and other improvements, it will get faster, and the number of good chips per wafer will rise, helping to drive down costs.

In a way, the 6x86 is Cyrix's Viper to Intel's Corvette. Both offer blazing performance. One bespeaks a legacy of incremental changes and improvements, while the other is an uncompromising, all-out-performance machine. Ironically, Cyrix has been truer to the x86 legacy than Intel has. Given the 6x86's arrival, Intel needs to bolt a turbocharger onto its current lineup or cede the performance race. It could, of course, do nothing and simply wait for 32-bit code to suffice the market. Or it could up the clock rates more aggressively on its Pentiums. It could even go back and retune the P6 to do a better job with 16-bit code. Whatever happens in this race, we're the winners. □



CPU INSIGHT

Intel must bolt a turbocharger to its current lineup or cede the performance race.

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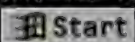
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Second Looks

LIVING WITH THE PRODUCTS WE REVIEW

Taming the PC Card Memory Monster

A while back (Second Looks, October 24, 1995), I mentioned that you can save the considerable memory overhead of your card services software by using a simple command line configuration program to turn on your modem.

A number of readers wrote me wanting more details. There's no secret technique. Most PC Card modems come with configuration software in case your laptop doesn't come with Card and socket services software. Practical Peripherals' excellent PC288T2, for instance, has a program called PCONFIG that turns on the socket, assigns an interrupt and COM port, and sets options. As a transient program, it takes no memory. But it does require you to set up a 2K excluded block in high memory, used for communication with the modem. When I use it, I get 81K more memory—

nothing to sneeze at on my Gateway Liberty. Zoom's utility, called ENABLE, is quite similar.

The downside is that you have to do a fair bit of tinkering to get your modem to work, including pulling lines out of SYSTEM.INI, editing your CONFIG.SYS file, and making adjustments to your memory management utility, if you use one. You'll also have to find out by trial and error whether your PC Card slots or modem come back to life after a suspend-resume cycle. If they don't, you will have to run the command line program each time you want to use a communications program. Of course, you can set up a Windows icon for it, if it's worth the 80K of gained memory. Not all laptops will benefit, however. Toshiba's new Portégé 610CT, for instance, has 613K of free memory even with the suite of card services loaded.—*BM*

Perfect Pair Possesses Printing Problems



Good gray-scale output.



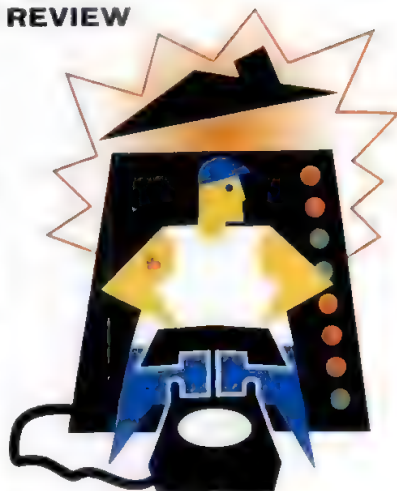
Corel and HP miss some lines.

You would think that using a combination of the two most popular products in their respective markets would make for a flawless union. Well, Corel Draw and HP LaserJet users know this isn't always the case.

Corel's famous drawing program has had trouble printing on Hewlett-Packard laser printers for quite some time now, and it doesn't look as if the problem has been resolved. In fact, if you've recently invested in an HP LaserJet 5Si MX

(see First Looks, December 5, 1995) and are planning on using Corel Draw, be sure to check the printer's .README file. It suggests a few tweaks be made to the printer driver and Corel Draw's .INI file in order for the two products to work together properly.—*TA*

How to contact Second Looks: On ZD Net type GO ZNT:EDITOR, and choose Views: Machrone. Contact Machrone directly via MCI Mail at Wmachrone or CompuServe at 72241.15. You can also find us on the World-Wide Web at <http://www.ziff.com/~pcmag>.



PC Card Modems and Digital Lines Don't Mix

This time last year, most PC Card modems shared a problem: Plug them into a digital PBX line instead of a regular analog line and they'd burn out. All of the manufacturers have since uprated their line interface components to handle the higher current, and some have built in detection routines that send a "bad phone line" message to your terminal program.

The engineers at Zoom Telephonics weren't happy just making their components more robust, because the current can still damage the PC Card if you leave the modem plugged in despite all warnings. Zoom Telephonics' new PC Card V.34C fax modem senses the high-current conditions caused by digital lines and opens a solid-state relay, effectively isolating the modem from the line as long as the condition exists. Digital line burnout is now a problem that's mostly behind us, but Zoom has taken the solution to new heights.—*BM*

LOOKING AHEAD

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Multifunction peripherals

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PC Card modems

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Remove-IT 2.0

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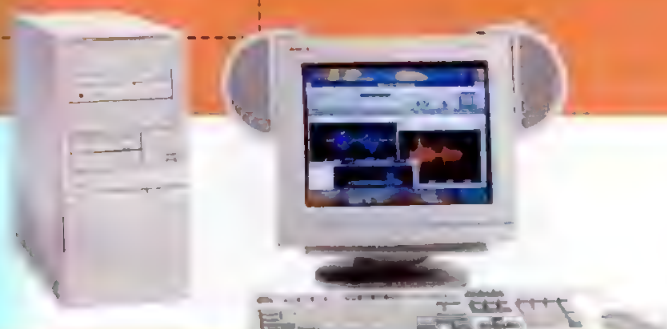
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The Naked Computer

Although nobody wants to admit it or discuss it, it's obvious that sex over the computer is growing in popularity. But America Online and CompuServe chat rooms, along with the IRC (Internet Relay Chat), are very successful as both dating services and

opportunities for the homeliest fat guy to be Brad Pitt and charm a woman (who may actually be a guy or a grandma) into exchanging sexual chitchat. Few of us who bought computers in 1976 for the purposes of programming and word processing ever thought this would happen. The big question is: Where will it end?

Well, now it gets kinkier. If you thought the hubbub over kiddie porn on the Net was loud, wait until this stuff hits the mainstream media. Let's start with CU-C-ME (See You See Me), a video protocol used on the Internet that lets you hook a camcorder to your PC and transmit live video images back and forth over the Net to strangers and friends alike. Certain Telnet addresses, which broadcast various situations for the computer world to see, can be checked out. Can you spell V-O-Y-E-U-R-I-S-M?

As we get newer and better compression algorithms for video and still-frame images, we'll approach the next major leap in desktop computing: video on the desktop. The concept of the VBBS (video bulletin board system) has always appealed to me. You call a local number and, for example, log onto the CHP VBBS to check road conditions by accessing specific cameras stationed at key intersections. Much of this can also be done over the Internet. Whatever the case, we will soon be surrounded by cameras and ways to access the cameras.

The porn aspect of this will likely get all the attention from the press, but the real action will be elsewhere. The novelty of watching Annie in Moosejaw strip naked and dance around like a ninny will quickly wear off. But we have to accept the fact that the pornographic use of this technology will dominate the mind-set of the computer-using public for at least a while. And we have to live with it until better uses appear or until everyone becomes bored with it.

As for the idea that desktop video will become a new platform for cybersex, I think that will actually be minimized by a couple of factors. First, few people are what they say they are, and everyone enjoys feigning a persona. Consider the skinny accountant who pretends to be the

large, leather-clad, dominant cop. Consider the shy and plain wallflower who pretends to be a drop-dead beauty—Miss Georgia, in fact. All these exaggerations are impossible on video. If you've got a beer gut, it's hard to hide it. If you're a 12-year old kid, it's pretty obvious on video.

There's the all-important embarrassment factor to consider. Whatever you do on camera can be recorded by the person at the other end and redistributed. These digital copies can be infinitely copied as well. So someone doing something silly may find he or she is the topic of discussion and the target of derision from Moscow to Auckland overnight.

This is kind of a touchy (and tasteless) subject to some people, I know, but I believe it needs discussion, because the pornographic aspect of desktop video will create a stir amongst the know-nothings in Congress and the gullible public at large. This stir always inspires the same "there ought to be a law" response. It's this response that must be avoided.

We have no idea where new and breakthrough technologies lead. The first time I saw real-time traffic-flow monitoring on a desktop, I was impressed. I had not thought of it and had previously considered desktop video the equivalent of having a video phone. The litany was always that you don't want to see the person you're talking to. Or you don't want them seeing you. That's true, but you wouldn't mind seeing the traffic on the bridge or the live action inside a

Paris restaurant you want to visit. This is the real use of desktop video, not the peep show.

Computers are like any technology: They can have a good side and a bad side. The good side concerns productivity and making our lives easier. The bad side is the ability to waste time. Whether it's chat rooms or never-ending Web surfing or the virtual CU-C-ME peep show, it's a time killer that we have to struggle individually to avoid or minimize. It's a personal decision. Try to keep this in mind when the next anticomputer, there-ought-to-be-a-law wave hits us regarding this new form of pornography. Fight the legislation and just say no to lewd sites.



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Inside Track

The chip **battle** heats up with the recent announcement by AMD that it will merge with NexGen, a company that has produced a Pentium competitor and announced a **Pentium Pro clone**. AMD has not been keeping up with the pack (Intel and Cyrix) with its slow-to-market K5 **Pentium clone**, let alone with something like the Pentium Pro CPU. This acquisition cuts one to two years off the company's time to market with a competitive processor. News reports in the San Francisco area celebrated the merger as having created a company capable of competing toe to toe with Intel. Not quite. The NexGen Nx686 is still **nine months** behind Intel latest offering. The good news is that the chip supposedly doesn't have the performance problems with 16-bit code suffered by the Pentium Pro.

Meanwhile, look for a chip from AMD dubbed the SSA5, which is actually **the original K5 in disguise**. The problem AMD was having with the K5 was that the chip could not achieve the **lofty performance promises** made by the company. So AMD took the lower-performing design and renamed it. It's believed that AMD may use the NexGen Pentium clone for what actually becomes the branded K5 chip.

Hot Java, Cool Concept Dept.: More interesting are rumors of a Java computer, with the likes of Sun Microsystems and Oracle joining forces to create what sounds a heck of a lot like a **dumb terminal** that will do nothing but Internet access. Oracle's Larry Ellison, who has made it a **tradition** to be in denial concerning the personal-computing revolution (much preferring the terminal/mini-computer model) is promoting this notion. But observers of this nontrend say that the key will be **Japanese technologies** combined with **forthcoming, digital wireless** quasi-standards cropping up in Europe and Japan. The vision is that we'll all be carrying wireless hand-held geek terminals everywhere and be jumping on and off the Net all day long.

When I hear about a concept like this, I think it's another one of Microsoft's **harebrained schemes**, such as the defunct MSX standard or the set-top box strategy or the floundering Microsoft at Work concept. But this time it's stemming from Netscape, which is obviously flying high because Jim Clark and Mark Andreessen intend to go after Bill Gates's pie.

Anyone who has been **watching Netscape and its acquisition strategy** can see that the company is grabbing, bit by bit, the technologies necessary to make what's best called a **network operating system**. This operating system is optimized for networking and especially In-

*Netscape is grabbing,
bit by bit, the technologies
necessary to make
what's best called
a network
operating system
optimized for the Internet.*

*This has Bill Gates
worried, for sure.*

ternet access as a client and a server. This has Bill Gates worried, for sure.

Netscape has never said in any public announcement that this is what it's doing, but you can tell who may have been **secretly informed** by observing who is hinting about this in the media.

This observation was triggered by a **wacky comment** by pop techno-guru George Gilder, who offhandedly said that Mark Andreessen of Netscape was going to be the next Bill Gates. On the surface, this remark was idiotic. Andreessen is a true technologist with an engineering mind. Jim Clark was the idea man behind Netscape, wasn't he? Gates is a businessman under the programmer's skin. The comment was **not an observation, but a coded**

message. The message was that Netscape is doing an operating system and is going to license it. "He's the next Bill Gates," in that regard. I assume that Gilder and others have been made privy to Netscape's real strategy: to develop **the next-generation OS** for personal computers.

New Technology Is Wonderful Dept.: Meanwhile the two competing Digital Video Disk standards are consolidating. **The battle** began back when there were two camps, each with its own incompatible format. The first was headed by Sony and Philips, along with Mitsumi, NEC, Nokia, and Aiwa, among others, and was called the Multi-Media CD format. Opposing them was a camp led by Toshiba, Hitachi, Mitsubishi, Samsung, Pioneer, and Panasonic (Matsushita), with the Super Density format. Both were generically referred to as DVDs—**Digital Video Disks**.

This could have been another VHS-beta format fiasco had this consolidation not occurred. It happened because a slew of computer companies refused to subscribe to either system. Both groups were **banking on this technology** being used extensively in the PC arena. It was a consortium led by Apple, Compaq, Hewlett-Packard, IBM, and Microsoft that just said *no*.

This unified format should **functionally replace both the laser video disk and the CD-ROM**, as well as become a CD-ROM writable format of the future. And the future isn't far away, as Philips and Sony say they will each have a product on the market in 1996.

The DVD will be one or two layers deep and can be single- or double-sided. Each layer will hold 4.7GB of data or up to **nearly 20GB on a standard 12-centimeter disk**. With talk of MPEG-2 encoding and HDTV resolutions, it's hard to say how many full-length movies can be packed onto one of these puppies, but the goal of one per side seems easily achievable. The kicker is that these disks are recordable. **Imagine the uses.** □

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George Eastman built a huge business with this slogan a century ago: "You push the button; we do the rest." Today, that slogan wouldn't fly; increasingly, photo enthusiasts want to do "the rest" themselves. At least, that's true of those who are starting to

use electronic cameras and PC-based digital darkrooms. And new and better tools are making photography a lot easier and more satisfying.

The photo market has been in chaos for years now. Traditional photo-equipment sales sagged in the eighties, as people traded a venerable older hobby for newer ones—often, the new hobby involved PCs. The market for high-quality 35-mm cameras and lenses slowed but hardly disappeared. These days, the photo business is roaring, though with a very different emphasis. While high-quality, interchangeable-lens 120- and 35-mm SLRs still sell, the photo market today is dominated by 35-mm "point-and-shoot" cameras—sometimes they're fixed-focus, sometimes they have small zoom lenses, and sometimes they're even completely disposable.

A different breed altogether is the new under-\$1,000 fully electronic cameras, which deliver .TIF files of long-palette color photos. This market is defined by three near-look-alike cameras; a fourth closely related unit is squeezing into the picture as well. The Apple QuickTake 150, Kodak DC40, and Logitech Fotoman Pictura are remarkably similar (they use many of the same parts and are all made by Kodak); Chinon's new ES3000 uses some of the same parts, but expands the feature set and digital photographer's horizons in important ways.

I think these are great tools, despite what at first glance seem to be serious image-quality limitations, their limited controls, and their high prices. (Though in a world of \$15,000 to \$20,000 electronic Canons, Minoltas, and Nikons, these under-\$1,000 cameras don't look quite so pricey.)

Yes, you could buy a high-quality 35-mm SLR and three good lenses for what one of these far simpler boxes costs; on the other hand, a film-based system can't deliver instant 24-bit-color snapshots that you can drop into DTP publications or put up on your personal Web page minutes after you shoot them.

In traditional photographic terms, the Apple, Kodak, and Logitech cameras compete with the simple, reusable,

fixed-focus 35-mm cameras you can buy in any drugstore for \$20 to \$30—but cost about 30 to 40 times as much. That's not a typo: The Apple unit lists for \$739, while the Kodak and Logitech siblings each have a list price of \$999.

Apple's version uses a masked-down variation on the same 768- by 512-pixel CCD (charge-coupled device) found in the Kodak and Logitech models. By reducing the size of the image captured to 640-by-480—the familiar VGA-screen size—Apple saved money on memory and tacitly acknowledged that for many of us, these cameras will be used in large part to snap nice Windows wallpaper images of our families for our notebook PCs. Apple puts just 1MB of memory in the QuickTake 150, which also means it can save only 16 or 32 images, depending on whether you select Standard or High Quality. (Tip: Forget the lower-quality-image setting in all three of those cameras, unless you only want tiny, thumbnail-size images).

The Kodak and Logitech systems use the full 768- by 512-pixel CCD; the Kodak stores 48 to 99 pictures, and the Logitech can save up to 144 pictures, though it does so by conveniently redefining "standard" resolution down to 384-by-256 pixels. Both models have +/- 2-stop manual exposure adjustments (used for backlight, for example); they also have 42-mm lens threads, which allow the attachment of simple diopter lenses for close-ups and screw-in telephoto and wide-angle lenses like those available for home video

cameras. Since these cameras don't let you see out through the lens, but rather through a small viewfinder window, framing with add-on lenses is a rough approximation.

All three, as well as the Chinon, have built-in flash.

The \$995 Chinon camera is a big step up, with a real f/2.6 35- to 114-mm 3:1 zoom lens, focusing, a macro mode down to 19 inches, a wide range of shutter speeds, and other advanced functions. It has only 1MB of memory, but can save images to a 4MB-to-20MB Type II PC Card (formerly PCMCIA), so the number of stored images is practically limited by your willingness to buy more PC Card capacity. The Chinon stores images in Standard, Fine, and Superfine resolu-



DIGITAL SNAPSHOTS

A film-based system can't deliver 24-bit-color snapshots that you can use minutes later.

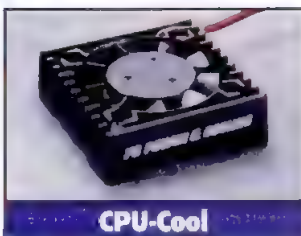
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JIM SEYMOUR

tion. The Standard images look pretty good but are limited to 320-by-240 pixels; Fine and Superfine are both 640-by-480, with more compression at the Fine setting. The Superfine images look amazingly good when they are output to a good color ink jet printer.

All four cameras dump images to your PC, into a contact-sheet-like form via a serial cable, which can be time-consuming. The software provided ranges from ho-hum (Photo Enhancer, with the Kodak camera) to primitive (the Chinon ES3000's transfer software). But the Chinon ES3000 includes a Twain driver, so you can use Photoshop or another Twain-compliant graphics package to grab and manipulate images. (Better still, watch for Adobe's dazzling new \$89 "Photoshop, Jr." consumer photo-editing package, PhotoDeluxe, due after January 1996.)

THE BEST AND THE REST

I've used all four cameras. The Chinon is the clear winner, because of its expanded features, even though the simple, fixed-focus, point-and-shoot boxes were pretty useful. My family, friends, and I have pumped a lot of images through these cameras, and I've used the Chinon for electronic publishing work that looked very good, indeed. It's been a joy to drop Chinon Superfine images I've just shot into PowerPoint slide shows, then run those shows just a few minutes later. I could have sold dozens of the Chinons if I were a dealer.

As that suggests, whether you think these new electronic cameras are wonders or duds will depend on how you expect to use their output. If you want to paste images into camera-ready newsletter pages—and the final size of the images is, say, 4-by-5 inches or less—you'll love 'em. If you want high-quality color images to place in computer-based slide shows, you'll think they're wonderful. If you want color images you can drop into reports, forms, and correspondence that you'll crank out on an ink jet printer, you'll be amazed. But if what you want is conventional photographic prints, the kind you get now from your Canon and Pentax, these electronic cameras aren't for you.

Comparing filmless systems with similarly priced film-based cameras misses the point. If you want *film*, shoot *film*. But if you want a high-quality, 24-bit-color electronic image that you can use directly or easily modify with PC-based imaging software—and you have a grand to spare—these are wonderful grown-up toys. And damned handy tools for anyone who deals with business graphics. □



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New PCs, Old Software

Oops. The PC software industry is out of sync with the PC hardware industry. Much of the software bundled with most of the 32 new home PCs reviewed in this issue ("PC Come Home") turns out to be a year old. Your new multimedia PC has

brand-new Windows 95 installed, but the applications on your system that have "95" in their names are fall 1994 titles.

As you know, we're seeing more software poised to move to annual updates. (That's why Windows 95 is called what it's called.) A disproportionate number of software upgrades now arrive in early fall, timed to meet the needs of home users making holiday purchases and businesses with use-it-or-lose-it annual budgets. But there isn't enough time during the fall for PC vendors to shift over and update their bundles of preinstalled software, or so they say. Instead, they often wait until their spring refresh of lines to shift over to the newer software.

Most PC vendors I spoke with essentially said: "Problem? What problem? We're giving people \$1,000 to \$2,000 of free software built into the purchase price, and we don't hear anyone complaining." They point out that anyone who really wants that 1996 version of Encarta, Bookshelf, or Works can go out and buy upgrades for \$25 to \$50. Do that for all your titles and you'll have spent \$200 to \$500 to upgrade your new PC to have current software. You should be annoyed if you had to spend extra to make your new PC truly new.

If I were a savvy PC vendor looking to get a leg up on the competition, this is what I would do:

Light a fire under my just-in-time manufacturing department, so that the 1996 titles are loaded onto at least the tail end of the 1995 buying season. The Windows 95 rollout shows that PC vendors, when they're motivated to move quickly, can have major new software loaded on their PCs and in stores about two months after the software code is locked in, or a month after the software ships to the public.

Lobby the industry's software vendors to advance the ship dates of their consumer software from early fall to midsummer, ensuring that 1996 software is on virtually all 1995 holiday-season PCs.

Barring that, offer users low-cost upgrades to 1996 versions of the software in the first quarter of 1996. Since most software now comes on CD and the documentation can go

on the CD, the manufacturing cost is about a dollar a program. A fee of \$25 would cover costs to ship the user a complete update.

While most consumer PCs are sold through the retail channel, it is the direct (mail-order) vendors that are best suited to exploit any demand for bundling most-current software, because they are such short-lead-time manufacturers. They take an order Monday, build the machine and preinstall software Tuesday, burn it in Wednesday, and have it on your doorstep Friday.

Direct vendors also can custom-configure software to suit the interests of you and your family in ways that retailers can't because of the problem handling multiple SKUs (stock-keeping units). In this regard, Gateway 2000 is light years ahead of the pack. A Gateway PC offers a hefty 40-title bundle, plus four time-of-purchase add-ons for \$59 to \$99 each; buyers can choose from seven family titles, eight kids' titles, eight flight-simulation games, or six sports games. They're good titles, too.

Finally, here are four thoughts on buying home PCs this fall:

A lot of home PCs are sold without secondary CPU caches, and it hurts performance about as much as dropping down a CPU level.

A printer bundled with a retail PC is usually a good deal, because it allows the retailer to advertise prices lower than the PC or printer vendor would allow if ad-

vertised separately.

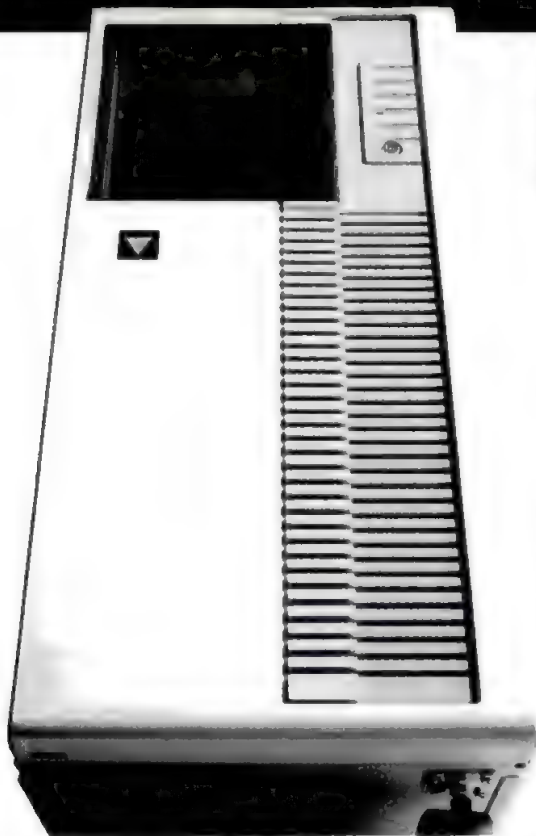
Some stores can be talked down \$100 from the ticketed price, but you've got a better chance of getting the sales rep to throw in some additional merchandise. Some stores also will refund any price reductions for a month after your buy, but you have to initiate the rebate.

If you have new-user friends who pester you with questions about what's the best PC to buy, we've prepared something just for them. It's called *PC Magazine Special Edition: Buying, Setting Up, and Using Your First PC*. It's available on newsstands, and the magazine title pretty much says it all. □



TIME WARP

You might have a brand-new PC, but its software could be a year old



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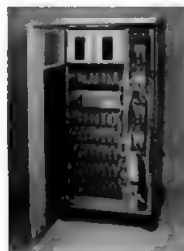
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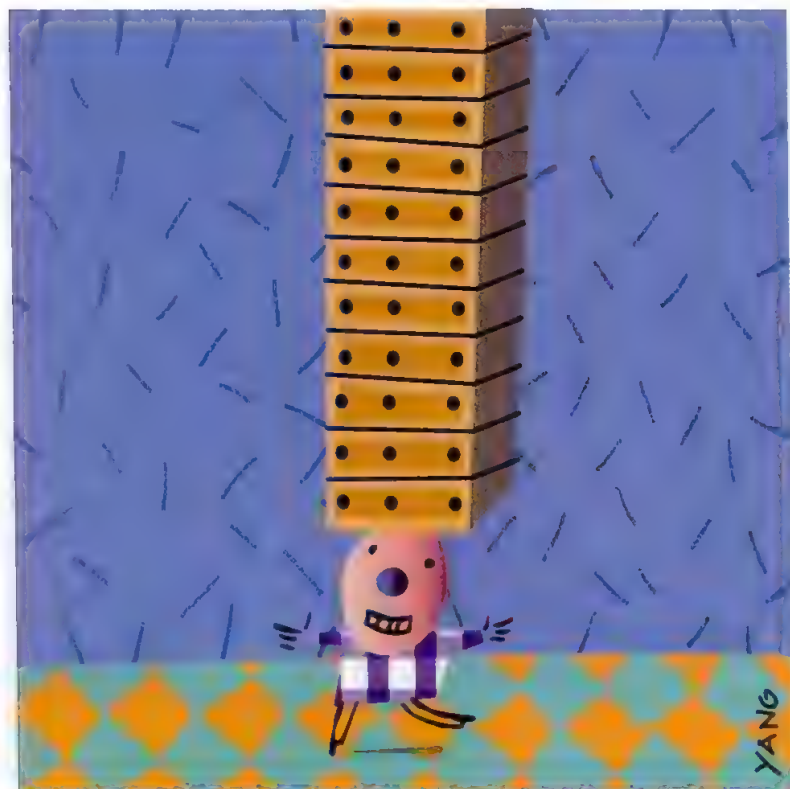
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NETWORK EDITION

STACKABLE HUBS

Stack Me Up

Everybody loves stackable hubs. Now vendors are showing off new stackable tricks, from switching to remote access.



By Padraic Boyle

One good thing generally leads to another. And so it is in the stackable arena. Plain old stackable hubs begat managed stackable hubs which begat stackable switching hubs which begat stackable routing modules and high-speed modules and remote-access units and wireless access points, and so on. There's no end in sight, and that's a good thing. The stackable approach to building your network makes

Illustration by James Yang

INSIDE



It's dizzying to watch a segment of the market as it reaches critical mass—when it explodes into a profusion of announcements, new releases, and marketing

hoopla. We're smack in the middle of the hoopla with the stackables market.

IT WAS, AFTER ALL, a natural progression. On the strength of the remarkable hit that stackable hubs have been, several large vendors are bringing out other stackable units that integrate into the hub stacks. It's a flexible, price-conscious, scalable, manageable approach for building your network—with all the functionality you need.

THE MAJOR DIFFERENCES between these stackable lines, reports contributing editor Padraic Boyle, are in interconnection, functionality, and management. Boyle, a veteran of many a wiring closet and server room, found these highly recommendable product lines.

ON THE FIRST LOOKS front, Ryan Tabibian reviews version 3.0 of Novell's software-based MultiProtocol Router. He reports on new features that enable it to rival solutions from traditional hardware router vendors like Cisco and Bay Networks. (Page NE21.)

AND ANOTHER COMPANY has entered the HSM market—but at something of an angle, says contributing editor Steve Rigney. Imagery Software's Group-Store HSM does some things worse, some better than other products. (Page NE24.)

RIGNEY ALSO REPORTS ON some nifty utilities for data recovery from Ontrack Computer Systems. These adjuncts to your backup plan can help recover even very recent work. They're priced well enough to argue their way into your server first-aid kit. (Page NE22.)

—Gail Shaffer

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NETWORK EDITION

COVER STORY

sense for several reasons.

With all of the network technology and solutions available today, you may feel like you have to be a magician to put together the combination of hubs and other devices that will make your network hum. You've got a lot more to think about than which cable type and category to use and what topology to deploy.

If necessity is the mother of invention, then the stackable market grew out of a need to bridge a gap between two established hub solution types: standalone and chassis-based. In this issue we take a look at stackable lines from three vendors: Digital Equipment Corp.'s MultiStack System, Hewlett-Packard's AdvanceStack, and 3Com Corp.'s SuperStack. We've also got sidebars on the lines from Bay Networks (BayStack) and Cabletron (HubStack), which were not released in time for review.

Standalone hubs were and still are ideal for small networks with few management needs. They're inexpensive and easy to use. You just plug them in and let them run. Chassis-based hubs, on the other hand, are a larger commitment. They offer the capability to condense a variety of network devices, such as Ethernet hubs, remote access, and routers, into a single manageable enclosure. But they're pricey and they're more than is needed for small environments.

Enter stackable hubs. When most network managers think of stackable hubs, they envision three or four Ethernet hubs, in a wiring closet stacked one on top of the other, connecting a small group of users. For the most part, they are correct. However, stackable solutions have come to be much more.

Stackable hubs combine the ease of use and cost-effectiveness of standalone units with many of the added features found in the chassis-based solutions, at a much lower price. These stackables can be used in a variety of installations.

The buy-as-you-grow nature of stackables makes them tantalizing for ever-expanding companies—for everything from connecting a simple 12-node workgroup to a 700-node enterprise network with an ISDN link back to the main office. For management aficionados, stackables can be configured and managed from a single location.

Don't misunderstand, though. Stackables are not intended to replace chassis-based hubs. In fact, each of the vendors we looked at also offers a chassis-based solution. The stackable solutions are aimed

AdvanceStack

There's a lot to like about each of these vendors' lines of stackable hubs and other network devices. In the end, we designated Hewlett-Packard's AdvanceStack as our Editors'Choice

based on its broad set of networking options, ample number of ports possible in the stack, and quality management software. The

Stack Manager basic hub configuration package comes free, and although HP OpenView for Windows is pricier than the other packages, we feel the cost is justified for what has become virtually an industry-standard package.

We especially liked the flexibility of the various hub units, the routing and high-speed modules, the RPS unit, and

the Dial-A-LAN product with its modem options.

Digital and 3Com are both veteran networking companies, and both offer very good, solid solutions here. Digital has paid particular attention to investment protection for its long-standing customers, with interoperability between its stackable

hubs and its chassis systems.

3Com probably comes in at the lowest price in some configurations, and also offers good flexibility and management features.



more at network managers with capacity planning in mind.

WHAT IS A STACKABLE HUB?

Stackable hubs are individual networking devices (Ethernet hubs, Token-Ring hubs, or remote-access servers) available in small-footprint boxes that can be placed on a table and stacked on top of each other or rack-mounted in a wiring closet. Each product can operate independently or be connected to others via a common connection to create one logical unit that can be managed from a single station. Stackables can combine a wide range of technologies, such as switching, routing, and ATM, into a single stack.

Stackable units are priced moderately, compared with chassis-based solutions. An SNMP-managed stackable hub will cost somewhere in the range of \$60 to \$75 per port for 12 ports. Because each vendor requires only a single managed repeater for each stack, the price per port drops as the number of clients increases. (In comparison, a chassis configured with 300 ports costs in the vicinity of \$175 per port; at the low end, an 8-port standalone Ethernet hub from Kingston Technologies costs about \$30 per port, with no management capability.)

On another front, why not just buy best-of-breed products to build your network? The answer is that this heterogeneous approach robs you of a centralized management platform. Because each

vendor supplies a proprietary management package, you would have to have them all running to reap all the benefits of a product. Stackable hubs, on the other hand, provide a platform that views the stack as single entity. Each port is viewed and managed as part of a stack.

A CHOSEN PATH

Chassis-based solutions provide management and connectivity between hub cards over a shared backplane. Some chassis vendors, such as Bay Networks (Synoptics), use a separate management bus to manage the installed hubs. Stackable hubs take a similar but not identical approach. And, because each hub can operate as a standalone unit, connecting them together becomes a design preference.

Among the products we reviewed, Digital's MultiStack line comes closest to that of a chassis, as described above. In fact, its stackable hubs are hot-swappable and interchangeable into the Digital 90 and 900 series chassis.

Digital supplies a common data path to exchange information by building an Ethernet network that links all of its devices with a coaxial cable. Separate management ports on the back of each hub are connected in a cascading manner, providing a path independent of the data path. The management ports can be connected in a loop, creating a fault-resilient management path.

HP's AdvanceStack is similar to Digi-

Visual Basic

**28 LINES OF CODE.
AND STILL NO INSERTS.
NO DELETES. NO QUERIES.**

```
Sub PubPubID_Change ()
Dim SavePlace As Variant
Dim SQL As String
If Loading Then Exit Sub
PubsTitles.Clear
PubsAuthors.Clear
SQL = "Select distinct Title from Titles"
SQL = SQL + " where titles.PubID = " &
    PubPubID.Text
DataCtl(PubsList).RecordSource = SQL
DataCtl(PubsList).Refresh
Do While Not DataCtl(PubsList).Recordset.EOF
    PubsTitles.AddItem
    DataCtl(PubsList).Recordset(0)
DataCtl(PubsList).Recordset.MoveNext
Loop
If PubsTitles.ListCount > 0 Then
    PubsTitles.ListIndex = 0
SQL = "Select distinct Author from Titles,
    Authors"
SQL = SQL & " where Titles.AU_ID =
    Authors.AU_ID and "
SQL = SQL & " titles.PubID = " & PubPubID.Text
DataCtl(PubsList).RecordSource = SQL
DataCtl(PubsList).Refresh
Do While Not DataCtl(PubsList).Recordset.EOF
    PubsAuthors.AddItem
    DataCtl(PubsList).Recordset(0)
DataCtl(PubsList).Recordset.MoveNext
Loop
If PubsAuthors.ListCount > 0 Then
    PubsAuthors.ListIndex = 0
End Sub
```

Oracle Power Objects

3 DRAG AND DROPS

These two programs do exactly the same thing. But Oracle Power Objects generates the application in under a minute with three drag and drops. Without writing a single line of code.

With Oracle Power Objects you can insert and delete data located on a server database without any modifications whatsoever. To do the same thing, the Visual Basic application would require hundreds of lines of code to be written, tested and debugged.

InfoWorld (8/7/95) confirms: "Unlike Microsoft's Visual Basic (VB), Power Objects is truly object-oriented. And Power Objects boasts cross-platform support that VB can't match." In fact, it lets you run Windows applications unmodified on the Macintosh. Experience the productivity benefits of a state-of-the-market, object-oriented client/server tool. For a limited time, upgrade from your current general-purpose development tool to Oracle Power Objects for just \$99. Offer expires 12/15/95.

To order: **call 1-800-633-0586, ext. 4495. Or log onto our web site at <http://www.oracle.com/>**

\$99
Competitive Upgrade



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tal's solution, except that only the Ethernet 10Base-T hubs connect together with coaxial cabling and independent management ports. Other network devices are managed in-band over the network or out-of-band via an RS-232 port.

3Com's SuperStack uses a combination of proprietary connectors on the back of each of its Ethernet hubs and uplink cables on the front panel to manage its hubs. Just like AdvanceStack, SuperStack manages the other hubs—non-Ethernet hubs—in-band or out-of-band using an RS-232 port.

HIGH-SPEED PATHS, AND MORE

One of the biggest buzzwords in the networking industry today is "high-speed." If you're a hub solutions vendor, you've got to offer high-speed solutions. Hewlett-Packard and 3Com already do so: In addition to 100VG-AnyLAN modules, HP supports 100Base-T Ethernet bridging using an optional 100Base-T module in its 10/100 LANSwitch, and 3Com supplies a 10Mbps-to-100Mbps bridge between two LANs. Digital plans to support high-speed technologies next year.

Each vendor of stackable hubs offers an assortment of network devices in its stack, in addition to the standard Ethernet. Although most of the offerings are similar, each vendor provides an extra piece that may encourage you to lean toward its solution.

Digital's MultiStack was the only one to integrate a wireless access point to accommodate the roaming user. 3Com's SuperStack and HP's AdvanceStack both offer optional redundant power supply (RPS) units for fault tolerance. For Token-Ring shops, 3Com also offers a Token-Ring stackable solution similar to its Ethernet stack. HP offers a four-port Token-Ring interface for its optional routing module. While none of the vendors reviewed had an ATM strategy in place, each has plans to offer it in the future.

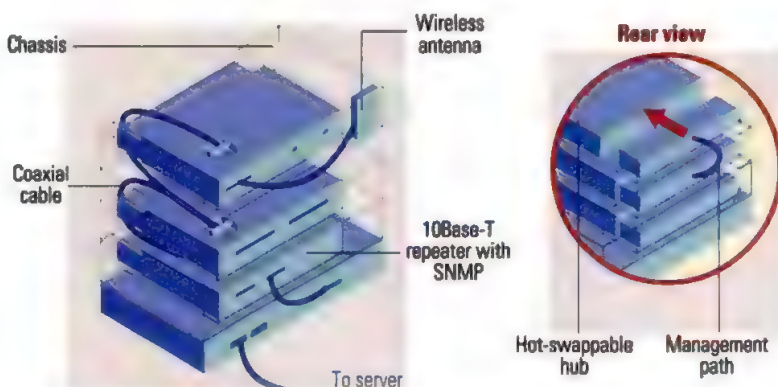
MANAGEMENT

Here's the key feature that ties these stackable units together: Each vendor supplies a proprietary, Windows-based management package that offers a graphical look into the ports in the stack, as well as statistics regarding the health of the network.

RMON support is available under each solution. 3Com includes RMON as a standard feature in its hub line, while HP and Digital offer RMON software and hardware at an extra cost.

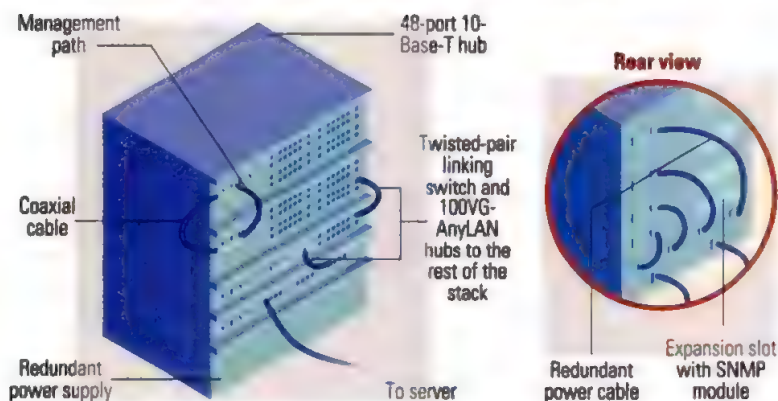
Digital MultiStack

Digital takes a unique approach to connecting hubs. Each hub snaps into a plastic housing, which is then stacked. The hubs connect via a coaxial cable attached on top of each. A separate management bus daisy-chains across the hubs.



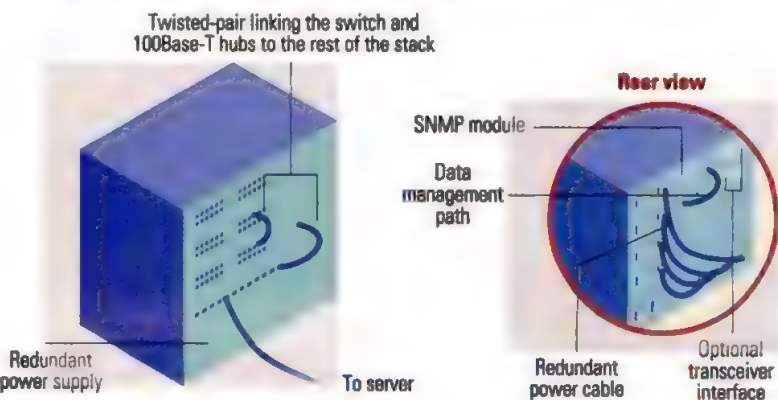
HP AdvanceStack

Hewlett-Packard, the only vendor with a 100VG-AnyLAN solution, lets you stack a maximum of 16 hubs, for a total of 784 ports—the largest in this roundup. All are still managed through one module. AdvanceStack hubs connect over daisy-chained coaxial cable.



3Com SuperStack

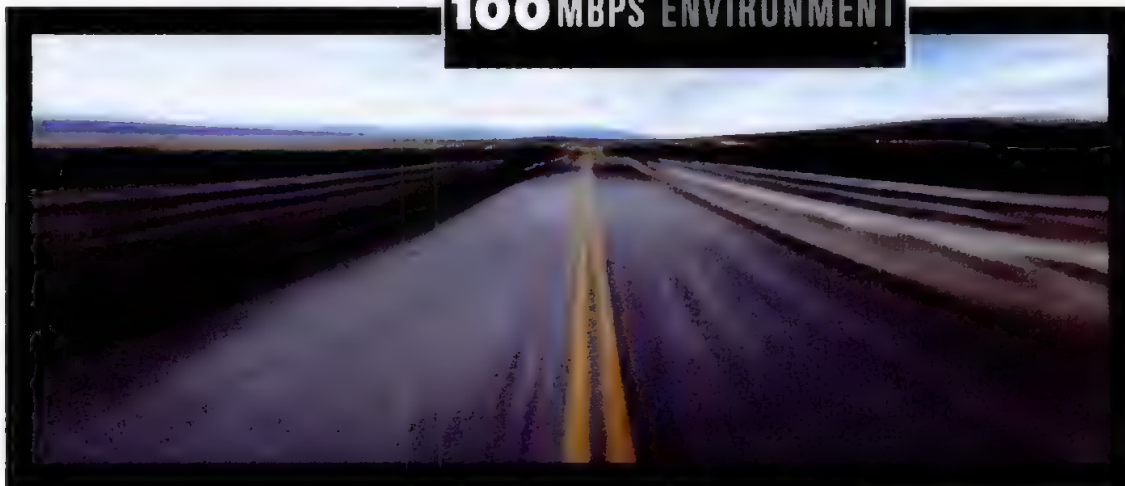
Unlike the other two vendors here, 3Com uses proprietary cable to connect its LinkBuilder 10Base-T hubs. These cables provide both connectivity and management. Like the HP AdvanceStack, 3Com's SuperStack line includes RPS units, each of which can protect as many as four hubs.



10MBPS ENVIRONMENT

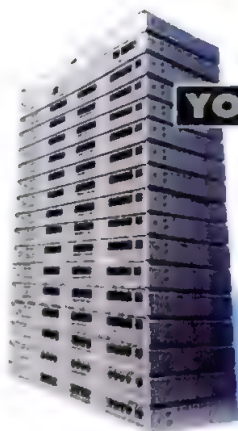


100 MBPS ENVIRONMENT



The Asanté 100BASE-TX Hub Solution

Let everyone travel at their own speed. With the AsantéFAST 100 stackable hub and AsantéFAST 10/100 bridge. The first solution to deliver 100Mbps performance with seamless, plug-and-play connectivity to your 10Mbps network. Stackable to 15 units and scalable to 358 nodes, Asanté's unique hub architecture offers you the industry's largest Fast



YOUR ALL-TERRAIN VEHICLE

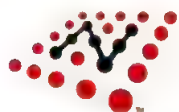
Ethernet collision domain. Plus, full SNMP management capabilities when you add the AsantéFAST 100 Management Module. And don't forget free technical support and lifetime warranty. Call for the Asanté reseller nearest you, and get a free copy of "Fast Ethernet. Adding 100Mbps Networks To Your 10Mbps LAN." <http://www.asante.com> or 1.800.662.9686, Dept. ISCC



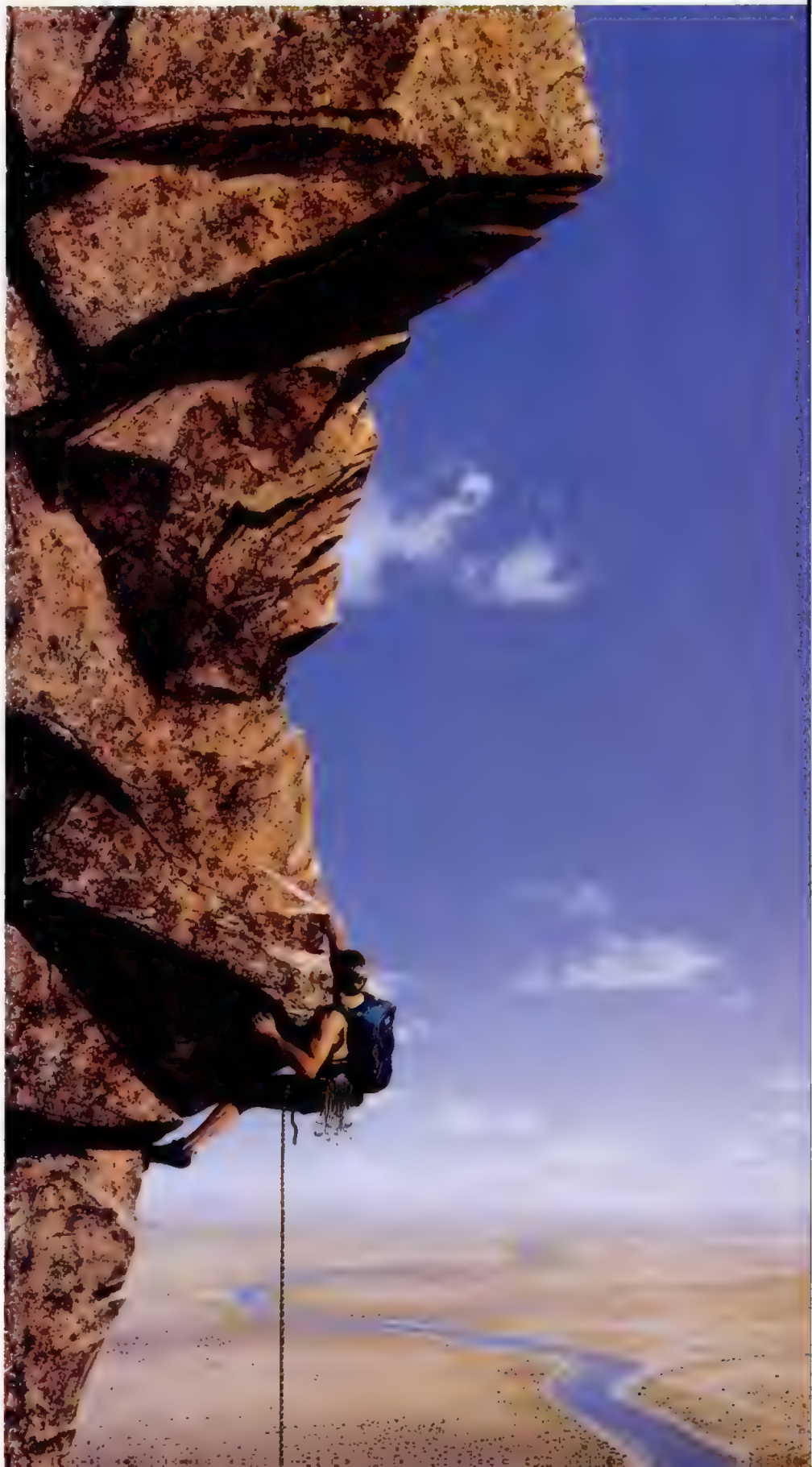
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Face it, networked computers have changed the way the world does business. ✎ Information is shared instantly. Problems are solved more easily. And you know what? The sky's the limit—thanks to that unprecedented resource called your network. ✎ At Compaq® and Novell®, we understand how critical reliability and performance are to your network. As business partners, we've been developing integrated solutions for over ten years. ✎ Which is undoubtedly one of the reasons why more of the world's businesses depend on Compaq and Novell than any other network solution. Shouldn't you? ✎ For more information, call 1-800-345-1518.

COMPAQ



Novell®



A man in a blue shirt and shorts stands on a narrow metal walkway high above a rocky canyon. He is looking down, and his reflection is visible on the metal surface. The walkway is part of a large structure, possibly a dam or bridge, with a railing. The sky is blue with some clouds. The rocky canyon below is rugged and brown.

A man in a blue shirt and shorts stands on a narrow metal walkway high above a rocky canyon. He is looking down, and his reflection is visible on the metal surface. The walkway is part of a large structure, possibly a dam or bridge, with a railing. The sky is blue with some clouds. The rocky canyon below is rugged and brown.

In addition, you can use Digital's HUB-watch for Windows to manage not only the MultiStack System, but the DEChub 90/900MS, the GIGAswitch/FDDI, and the GIGAswitch/ATM. Similarly, 3Com's Transcend covers the breadth of its product lines. HP's OpenView, practically an industry standard in network management, adds plenty of power itself, in a couple of different flavors.

Digital, HP, and 3Com all require that you have one—and only one—SNMP module to manage a stack of Ethernet hubs. This helps keep the price down for the hubs. However, you must purchase an SNMP module for every other piece in the stack.

Stackable solutions are an excellent choice for small, medium-size, and large networks—especially those supporting remote offices and users. Their low cost, flexibility, and effortless installation provide for easy expansion and a migration upgrade path to bigger and faster networks. Even network managers with large chassis-based sites may find stackables a great approach for filling in gaps.

It's a neat trick.

Digital Equipment Corp.

MultiStack System

ALL REVIEWS BY PADRAIC BOYLE

There's a lot of versatility built into the MultiStack System. In addition to Ethernet hubs and switching, Digital Equipment Corp.'s stack offers remote access and wireless units—and it's the only one here with the latter.

MultiStack also provides excellent investment protection because it uses the same hubs in its stack as Digital does in its chassis-based solutions. The only thing that changes is what they snap into. One shortfall, the lack of a high-speed solution for the stack, will be addressed in 1996, when Digital will offer support for 100Base-T and ATM.

Digital takes a unique approach to connecting the individual MultiStack pieces. First, the hubs snap into plastic housings that can either be stacked one on top of the other like Lego blocks or fitted with brackets and mounted in a 19-inch rack. The stacked units are connected via a coaxial cable that attaches through a 10Base2 terminal on top of each. This creates a back-

plane-style data path.

A separate management bus, made up of twisted-pair ports on the back of each housing, daisy-chains the devices together. They can be connected in a loop for a fault-resilient management structure. HP's AdvanceStack product line attains a similar goal, but only with its 10Base-T hubs.

Like the other stackable solutions in this review, only one Digital SNMP-capable hub in the stack is needed to manage all of the other hubs. Both of Digital's SNMP-capable hub models are capable of managing as many as 14 DECrepeater 90T-16s in a stack, creating a total of 232 managed 10Base-T ports.

Digital's switching hub was not designed as part of the MultiStack family. A different shape and size, the DECswitch is rack-mountable and comes in three flavors, each with six Ethernet ports. In contrast, HP's LAN Switch offers 16 switched 10Base-T ports and optional high-speed ports.

The DECswitch can switch and route automatically by way of a software upgrade. This combination is useful if you have nonroutable protocols on your net-

How They Stack Up

	Ethernet	Token-Ring	Fast Ethernet (100Base-T)	100VG-AnyLAN	Switching
Digital MultiStack	DECrepeater 90TS (8-port 10Base-T hub), \$995. DECrepeater 90T-16 (16-port hub), \$795. DECrepeater 90FS (2-port ST-fiber), \$1,595. DECbridge 90 (workgroup-to-backbone bridge), \$1,995. Maximum of 14 90T-16 hubs in a stack, for a total of 232 managed 10Base-T ports in one management domain.	Not offered in the MultiStack line.	Not offered in the MultiStack line.	Not offered in the MultiStack line.	PEswitch 900TX (six Ethernet RJ-45 ports, one DAS FDDI; supports 64 MAC addresses); as a stackable switch, \$4,795; as a DEChub ONE module, \$3,995. DECswitch 900 EE and EF have four RJ-45 ports each. 900 EE has 2 AUI; 900 EF has 1 AUI, 1 DAS FDDI. Both support 8,000 MAC addresses. As a DEChub ONE module: 900 EE, \$5,995; 900 EF, \$7,995. As a stackable switch: 900 EE, \$6,345; 900 EF, \$8,345. Each is upgradable to an IP or a multiprotocol router.
HP AdvanceStack	AdvanceStack 10Base-T Hub 8u (upgradable management hub), \$299. 10Base-T 16u (upgradable management hub), \$579. Hub 12 (with expansion slot), \$849. Hub 24 (with expansion slot), \$1,459. Hub 48 (with expansion slot), \$2,739. SNMP module, \$549. (Bundled pricing is slightly cheaper.)	Four-port Token-Ring interface, \$6,495. Connectivity through expansion slot on Ethernet Hub 12, Hub 24, or Hub 48.	Switch unit and a dual-port optional module, \$6,495. Connectivity with 100Base-T through the 10/100 LAN.	AdvanceStack 100VG Hub-15, \$3,199.	AdvanceStack 10/100 LAN Switch-16, \$6,495.
3Com SuperStack	Ethernet LinkBuilder FMS II (Ethernet-based stackable wiring hub), with 12 ports, \$879; with 24 ports, \$1,549	LinkBuilder FMS TR (Token-Ring-based stackable wiring hub); with 12 ports, \$2,095; with 24 ports, \$2,095.	Fast Ethernet LinkBuilder FMS 100 (Fast Ethernet-based stackable hub) with 12 ports (an additional media-flexible port is optional), \$2,899; 48-port multipack, \$9,552.	Not offered in the SuperStack line.	LinkSwitch 1000 (24 switched Ethernet ports, 1 FDDI port), \$4,975. LinkSwitch 1200 (Ethernet/FDDI-based switch ports, 1 FDDI port), \$6,995. LinkSwitch 2700 (Ethernet/ATM-based switch for workgroups, 12 Ethernet ports/1 ATM port), \$8,400.

COVER STORY

work. The DECswitch 900EF provides an FDDI port to create a fat-pipe connection between the hubs on the switch and a server or backbone.

Another option is to install a DEC-switch in the stack and create six individual Ethernet broadcast domains. Digital calls this approach a Switched Edge Stack. You remove the coaxial data-path connections, then connect each hub to the DECswitch, creating as many as six independent, switched LANs that are still manageable in a single view. You gain performance, but the management structure is kept intact. Switched Edge Stack is similar to Digital's enVISN (enterprise Virtual Intelligent Switched Networks) architecture, but instead of creating segments within a stack, enVISN connects multiple stacks to a single DEC-switch.

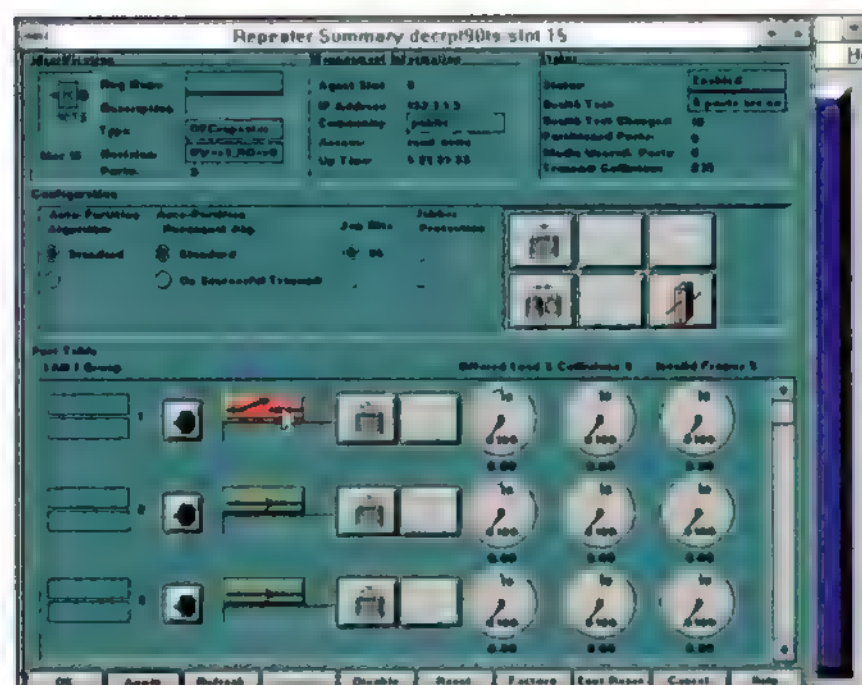
Digital provides connectivity from remote offices to a central site or backbone network with its RouteAbout EW. It has one Ethernet interface and two T1/E1 serial lines.

Users can connect remotely through Digital's NetRider 90 remote-access sys-

tem. NetRider combines a remote-access server and client software for IPX, TCP/IP, and AppleTalk. But unlike HP's Dial-A-LAN, NetRider has no dial-out capabilities (which Digital plans for 1996). NetRider has eight RJ-45 ports and supports speeds of up to 57.6 Kbps. You can use NetRider to manage the MultiStack remotely.

Digital was the only vendor with wireless communications as part of its solution. The RoamAbout incorporates a repackaged version of AT&T's wireless access point and software for roaming clients. But Digital was also the only vendor not to offer a redundant power supply unit.

HUBwatch for Windows, Digital's management utility for the MultiStack, is the same program that manages the DEChub 90/900MS, the GIGAswitch/FDDI, and the GIGAswitch/ATM. Com-



THE HUBWATCH SOFTWARE features an attractive interface and manages many of Digital's chassis-based products as well.

pared with HP's \$2,829 OpenView for Windows, the \$495 HUBwatch for Windows is by far the least expensive management tool in this review.

For large installations that require more firepower, a \$2,432 Unix version works with OpenVMS, HP OpenView, SunNet Manager, Digital Manageworks, and Novell NMS. For those who want to

Routing	Remote access	Wireless	Redundant power supply	Management platforms	Warranty
RouteAbout Access EW (multiprotocol version), \$2,515. Connects remote offices with Ethernet to central site or backbone network. In addition to one Ethernet interface, each router has two T1/E1 serial lines for connection to private lines or public network services such as X.25 or frame relay.	Digital NetRider 90, \$3,650. A complete client/server packaged solution that combines an 8-port (RJ-45) remote-access server with client software for TCP/IP, IPX, and AppleTalk systems. Speeds of up to 57.6 Kbps.	RoamAbout Access Point, RoamAbout 915 DS/PC Card (wireless network adapter and protocol-independent bridge with protocol and address filtering; redundancy via IEEE 802.1d spanning tree), \$2,705 (module and adapter).	Not offered in the MultiStack line.	HUBwatch for Windows (GUI-based SNMP platform to manage MultiStack System, DEChub 90/900MS, GIGAswitch/ATM), \$495; DECpacketprobe 90, \$3,105; PROBEwatch for Windows, \$2,990.	DECRepeater 90TS and 90T-16: lifetime. DECbridge 90, DECRepeater 90FS, DECswitch 900 EE, DECswitch 900 EF, Digital NetRider 90, PEs switch 900TX, RoamAbout Access Point, RoamAbout 915 DS/PC Card, RouteAbout Access EW: 1 year.
HP offers 15 router options to connect the AdvanceStack to most LAN or WAN topologies, from those that plug into the 10Base-T expansion hub (with 12, 24, and 48 ports, \$1,999) to 10-Base-T modules (with 4 ports, \$3,995) and dual-attached FDDI and 100-Mbps LANs.	AdvanceStack Dial-A-LAN 2A/Plus (module with two integrated modems and SNMP module bundle), \$2,399; with 2 ports, \$3,099; with 4 ports, \$2,499.	Not offered in the AdvanceStack line.	For up to four hubs in a stack, \$1,495.	Stack Manager, free; HP OpenView for Windows with Interconnect Manager Bundle, \$2,829; HP Bundle, \$2,829; HP OverView for Unix.	Hardware: lifetime (5 years on site).
NETBuilder Remote Office (Ethernet-based router that includes 3Com's Boundary Routing system architecture; for enterprise networks with one to three LANs), \$3,696.	AccessBuilder 2000 (Ethernet-based remote-access server for workgroups; with 4 ports, \$2,795; with 8 ports, \$3,895).	Not offered in the SuperStack line.	For up to four hubs in a stack, \$1,495.	Transcend Network Management Platforms for Windows, Unix, NMS, OS/2, HP OpenView, SunNet Manager, NetView, and AIX.	LinkBuilder: lifetime. AccessBuilder, NETBuilder, LinkSwitch: 1 year.

Only a remote access server this flexible can get away with an ad this uptight.

Product name: RAD MBE-RAS LAN Ranger

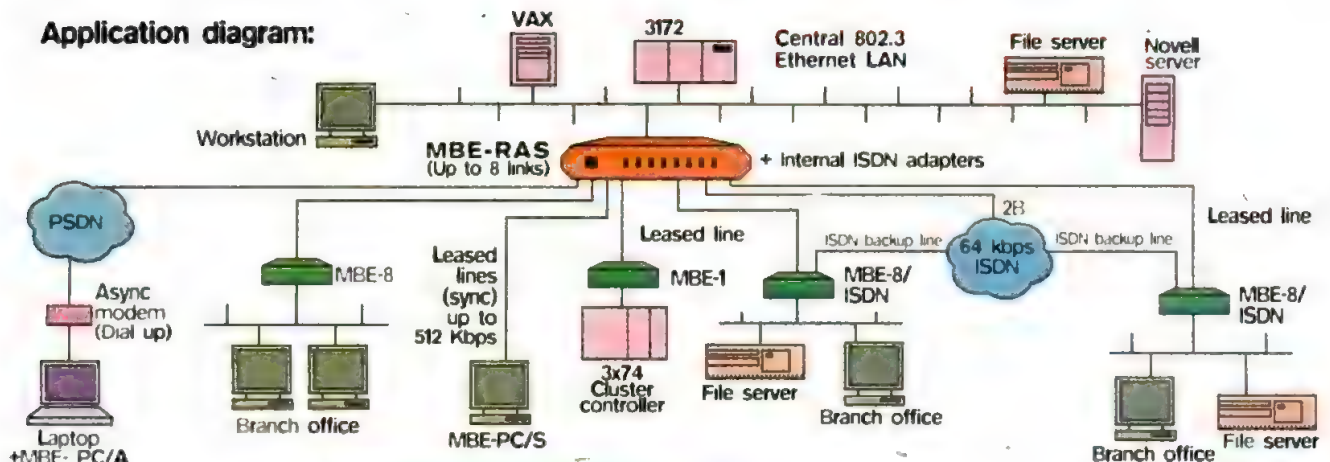
Application: Remote LAN access

Product description: Multiport async/sync remote access server

Product benefit: Provides **simultaneous LAN connections** for up to **8 remote LANs** or PCs supporting **250 workstations**. Configurable for both async and sync at data rates up to 115.2 kbps async and 512 kbps sync. Compatible with **all level 3 protocols**. Supports DOS, OS/2 and Windows. Features interfaces for **frame relay, ISDN, leased line, dial-up** and **connection-on-demand**. SNMP agent provides in-band management.

Support: **Expert engineering** staff can be reached by phone (see listings at bottom of page), or e-mail market@radusa.com. Catalogs and technical specifications for the **full line of remote access products** are also available.

Application diagram:



Product photo:



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data communications

RAD Data Communications, Inc.
e-mail address market@radusa.com

U.S. Headquarters: 900 Corporate Drive, Mahwah, NJ 07430 **Tel:** 201/529-1100 **Fax:** 201/529-5777 **Midwest:** Tel: 708/342-9999 Fax: 708/342-9986
West Coast: Tel: 714/897-2448 Fax: 714/897-1764 **International Headquarters:** 8 Hanechoset Street, Tel Aviv 69710 Israel **Tel:** 972-3-6458181 **Fax:** 972-3-498250

CIRCLE 923 ON READER SERVICE CARD

get down to the packet level, Digital offers the DECpacketprobe and PROBE-watch for Windows. These provide monitoring and offer all nine RMON groups for the LAN.

MultiStack System. *Digital Equipment Corp., Littleton, MA; 800-457-8211; fax, 508-392-0603; Web, <http://www.networks.digital.com>.*

Circle 965 on reader service card

Hewlett-Packard Co.

AdvanceStack

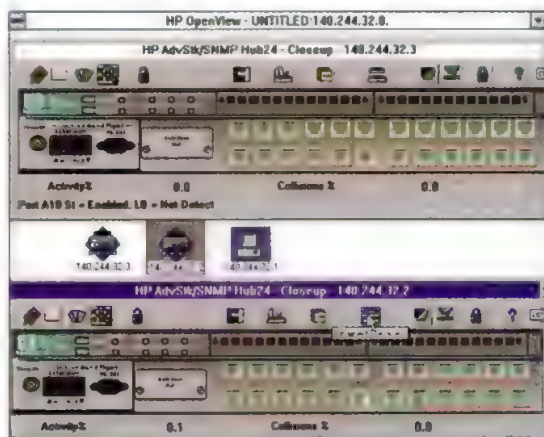


Here's another vendor that has been in the hub business for a long time, and its experience shows. The AdvanceStack, from Hewlett-Packard Co., offers a wide array of networking modules for all network sizes. AdvanceStack also provides the broadest choice of routing options here, and HP was the only vendor with a 100VG-AnyLAN solution. HP also offers strong network management software and connections.

Like Digital's MultiStack System, AdvanceStack hubs daisy-chain together over coaxial cable. This data path is a basic Ethernet network that acts as the backplane for the Ethernet hubs. If one hub needs to be replaced, only the users on that hub are affected.

AdvanceStack Ethernet hubs are available in 8-, 12-, 16-, 24-, and 48-port denominations. A maximum of 16 10Base-T hubs can be assembled for a total of 784 ports, the highest total here. The single stack of hubs is managed through one SNMP module (\$649) installed into any one of the hubs' option slots.

The 24- and 48-port units are available with telco connectors on the front, so they can connect directly to a patch panel or punch-down block, or, for standard RJ-45 connectors, to a 12-port breakout box. There is also a separate transceiver



WORTH THE COST: HP OpenView comes with AdvanceStack, and helps to make it a great stackable product line.

port available on the front panel of the Ethernet hub that connects the stack to another stack or to a centrally located hub.

And there's an extra bonus if you're looking to move to 100VG for high-speed networking: the 15-port 100VG-AnyLAN hub. Management and/or

Bay Networks Attacks the Stack

With its BayStack line, Bay Networks hopes not only to make building a network simpler but also to alleviate confusion over matching the company name to the stackable hub line. BayStack offers a comprehensive and cost-effective means of networking for small- and medium-size LANs, and adds high-speed and remote-office connectivity as well. Bay Networks also hopes to simplify configuring BayStack's hubs and routers with two easy-to-use management applications.

Similar to 3Com's SuperStack, BayStack offers a mix of Ethernet hubs, ranging from 12- and 24-port 10Base-T models (\$899 and \$1,549, respectively) to one with 6 switched 10Mbps ports (\$2,995) to a 12-port 100Base-T high-speed networking hub (\$2,375).

You can stack a maximum of 10 10Base-T hubs together for a total of 240 unmanaged ports. Optionally, 2 ports can be added to each hub for a total of 260 ports. For an additional \$699, a standard Network Management Module (NMM) adds management to the entire stack of 10Base-T hubs when installed in the option slot on the back of any one of them.

Moreover, BayStack gives you the capability to construct three or ten independent Ethernet segments in a single manageable stack. This feature is particularly useful when your business is looking for more bandwidth and thinking of migrating the LAN to high-speed networking.

Proprietary connectors and cables connect the 10Base-T hubs together. The hubs are cascaded, creating a data path between the units. Separate twisted-pair management

ports are likewise cascaded for a separate management path. As is the case with most stackables, adding the switch, 100Base-T, or Access Node hubs to the stack requires a twisted-pair connection from one port to another on the front panel.

BayStack's Access Node and Access Node Hub provide routing between remote offices and central locations. Even small offices with eight or fewer clients can take advantage of Access Node Hub's Ethernet hub/routing capabilities. And the BayStack lines include a redundant power supply to support any four BayStack hubs, adding fault tolerance.

To simplify installing and configuring BayStack, Bay offers two Windows-based applications, EZ LAN and EZ Internetwork (\$99 each until January 31, 1996, then \$495 and \$695, respectively). EZ LAN views and monitors the BayStack hubs graphically and offers current status and alarms. An intuitive interface provides auto-discovery of all devices on the network, including hubs, servers, and clients. EZ Internetwork, on the other hand, removes the hassles of setting up and configuring the Access Node router with its Quick2Config tool. This tool presents a graphical view of the router and allows for easy manipulation. Moreover, other NMMs can be added to offer 10Base-T autotopology (\$2,599) or RMON (\$999) support.

Despite a lack of remote network access for users on the go, BayStack covers all the bases to network your network.—*PB*

BayStack. *Bay Networks Inc., Santa Clara, CA; 800-822-9638; Web, <http://www.baynetworks.com>.*

Circle 973 on reader service card

bridging between the clients on a 10-Mbps hub and the 100VG segments requires an SNMP/bridging module (\$1,399).

AdvanceStack's 10/100 LAN Switch-16 hub provides 16 10Base-T switched ports and 2 slots for optional high-speed interface modules. Currently, a 2-port 100VG-AnyLAN module is available, for a total of 20 ports—16 switched 10-Mbps ports and 4 100VG-AnyLAN ports. A single-port Fast Ethernet 100Base-T module is also available, for a total of 18 ports (16 switched). Future modules will include 155-Mbps ATM.

HP integrates routing capabilities into AdvanceStack through modules that install into expansion slots on the various hubs. Routing is available for practically any solution, ranging from standard LAN-to-LAN to dual-homed FDDI and 100Base-T to WAN connections.

Another module, this one for remote access, is the result of a joint effort by HP and Shiva Corp. Dial-A-LAN installs in the expansion port of the AdvanceStack 12-, 24-, or 48-port 10Base-T hubs. A 2-port module with integrated V.34 mo-

dem (\$2,999) or a 4-port module (\$2,399) with standard RS-232 connections are also available. They include software for both dial-in and dial-out over IPX and IP.

Like 3Com, HP offers a redundant power supply (RPS) unit. The RPS supplies backup power for up to four devices. It has two power connections for additional redundancy, but it has no SNMP capabilities for alerting the network manager.

WHO'S MANAGING ALL THIS?

The Ethernet hubs are managed over a separate series of cables that daisy-chain between dedicated ports on the front of the hubs. Stack Manager, AdvanceStack's basic configuration and entry-level management utility, offers a graphical image of each hub in the stack via a serial port on the back of one of the Ethernet hubs.

Stack Manager will provide plenty of power for a small network. Medium-size networks may need the next tier of network management, HP OpenView for Windows and the Interconnectivity Man-

ager (ICM). HP OpenView for Unix is for even more complex WANs.

HP OpenView for Windows and ICM come bundled for \$2,829. However, though the package is capable of managing AdvanceStack hubs over IPX or TCP/IP protocols, you can't manage all of the components over NetWare's IPX. The 10/100 16-port LAN switch, for example, requires TCP/IP to be installed on your management station.

HP EASE (Embedded Advanced Sampling Environment), a part of the SNMP modules, offers the ability to monitor traffic and perform a trend analysis to help optimize your network. And, as with Digital's DECpacket probe, RMON capabilities are available by means of the HP Traffic Probe, an external probe box (\$595) and ProbeView software (\$3,560).

Network managers can easily reap the benefits of AdvanceStack's remarkable reach because of its flexibility, expansiveness, and excellent management features.

AdvanceStack. Hewlett-Packard Co., Santa Clara, CA; 800-533-1333; fax, 800-

Cabletron HubStack

Better known for its chassis-based MMAC hubs, Cabletron will be throwing its hat into the stackable hub ring with the HubStack family of Ethernet and Token-Ring hubs. HubStack offers many features found in other stackable solutions, such as remote access and routing, but you'd better be prepared to pay for them. A 48-port Ethernet unit costs approximately twice as much as HP's AdvanceStack equivalent.

HubStack supplies connectivity for Ethernet LANs with three different models: the SEH nonintelligent hub, and the SEHi and MicroMMAC intelligent hubs. These three hubs are similar in physical design and are available in 12- or 24-port models with your choice of RJ-45 or telco connectors. The 12-port versions are also upgradable to 24 ports.

Depending on the model of hub, one or two additional ports are optional, for a total of 13 or 26 ports per hub. As many as five SEH hubs can be stacked, for a total of 130 ports, without management. To add management capabilities, you simply replace one of the SEH hubs with an SEHi or a MicroMMAC.

By themselves the SEH and SEHi series of Ethernet hubs are strictly for small workgroups. However, when combined with the MicroMMAC and its module port, wide area and remote connectivity become possible. The bridge/routing modules, or BRIM as Cabletron refers to them, plug into the back of the hub, allowing connectivity to local and remote LANs via Ethernet, Token-Ring, FDDI, or ATM. Or, you can install a remote-access

module called the Micro-CS, which allows for dial-in access. The Micro-CS was codeveloped with Xylogics and can support as many as seven modems, printers, or terminals.

Much like 3Com's SuperStack solution, connectivity and management between the HubStack Ethernet hubs is handled over proprietary cables and connectors on the back of the units. HubStack also offers a similar stackable solution for Token-Ring networks. However, unlike the SuperStack, there is no switching, high-speed networking, or RPS unit available.

HubStack's SEHi and MicroMMAC hubs are managed using a Windows-based package called StackView (\$1,495). Similar to other stackable solutions, all of the stacked hubs are viewed as a single device. The network topology is viewed in several sublayers and a graphical representation of the hubs' front panel is displayed. Moreover, the MicroMMAC hub includes RMON capabilities and Cabletron's Distributed LAN Monitoring (DLM) software. Cabletron's own Spectrum for Open Systems and Remote LANview for Windows are also capable of managing the HubStack and other Cabletron equipment—but for roughly three times the price of StackView.

Overall, Cabletron's HubStack provides the basic connectivity needed for local and remote workgroups. However, the price you pay is by no means basic.—PB

HubStack. Cabletron, Rochester, NH; 603-332-9400; Web, <http://www.ctron.com>.

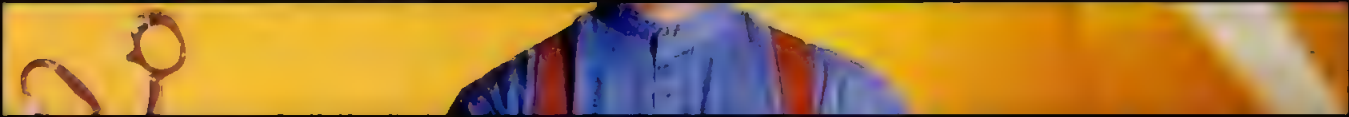
Circle 974 on reader service card



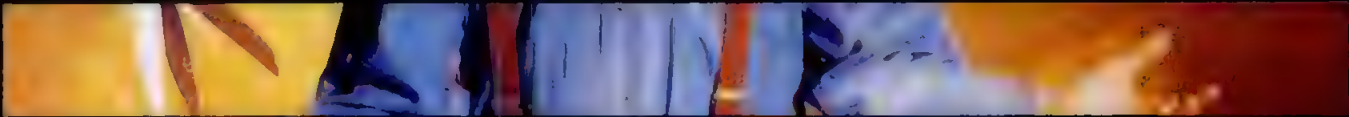
Production wants 3-D models off the server.



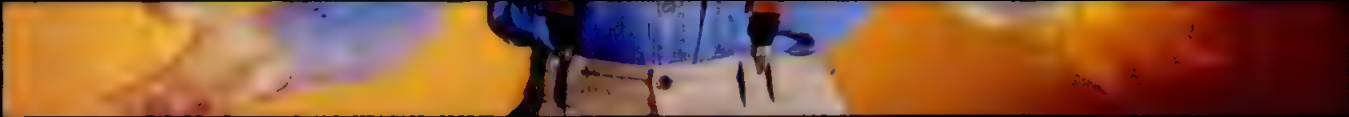
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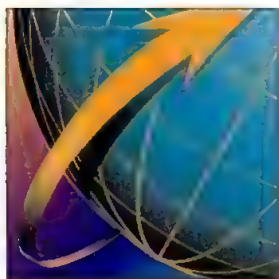
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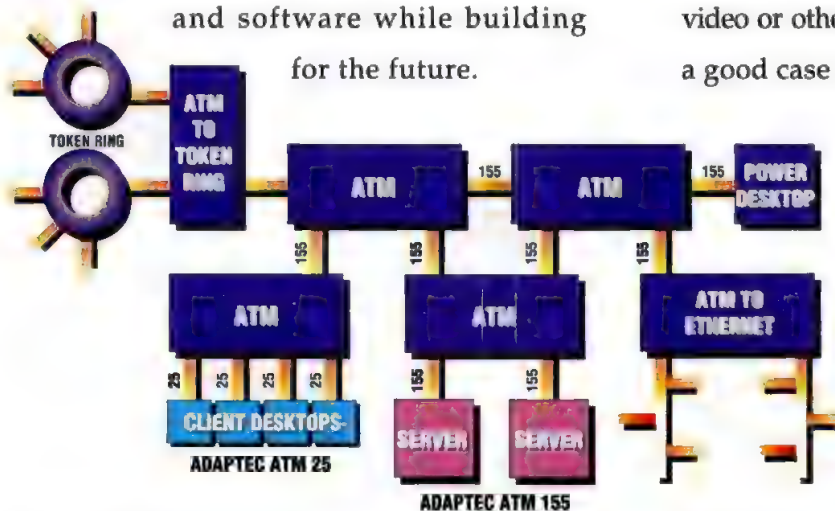
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*Median per-port list price of standalone switches. Source: 1995 Infonetics Research, Inc.

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Circle 966 on reader service card

3Com Corp.

SuperStack

Another vendor that's been around the networking block, 3Com Corp. offers a wide variety of hubs in its SuperStack. SuperStack covers practically every aspect of networking at a low price including switching, various high-speed links, and wide-area connectivity.

Unlike the Ethernet hubs offered by Digital and HP, 3Com's SuperStack uses proprietary cables to connect its LinkBuilder 10Base-T hubs in the stack. These cables provide for both connectivity and management. Connections to hubs that are not part of the LinkBuilder family are made through an RJ-45 port on the front of each unit.

The LinkBuilder FMS II 10Base-T Ethernet hub comes with 12 or 24 RJ-45 ports, 24 telco ports with two telco connectors, or 6 fiber ports. An optional slot on the back of each hub lets you install a transceiver interface module for connecting the stack to a backbone.

As with the other stackables, only one Ethernet hub is required to have an SNMP module to manage all of the other Ethernet hubs in the stack. However, only eight Digital hubs can be stacked, for a maximum of 208 managed ports (compared with the HP AdvanceStack's 784 ports). A 12- or 48-port 100Base-T hub can be added for high-speed connectivity.

SuperStack's high-speed solution, the FMS 100 Fast Ethernet hub, is not currently manageable but will be sometime in 1996. An uplink connection is used to connect the clients on the 10Mbps LAN to the Fast Ethernet network in the stack.

Switching has always been the next logical step to improve network performance cost-effectively on your Ethernet LAN. SuperStack's LinkSwitch family of switches, with port densities ranging from 6 to 24 ports, can also boost overall network performance. In addition, the LinkSwitch family offers high-speed links such as FDDI, Fast Ethernet, and ATM for servers and backbone networks.

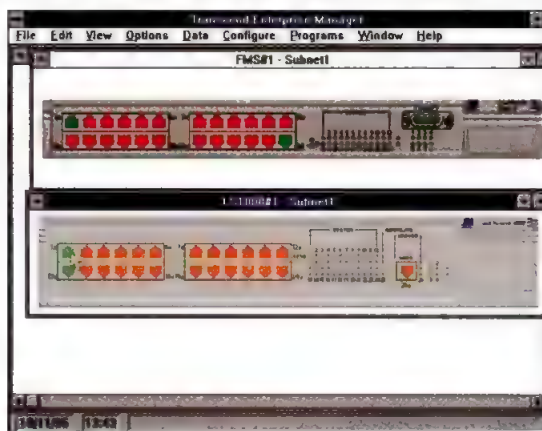
Connecting to the SuperStack from remote offices is made possible with 3Com's NETBuilder Remote Office hubs. Available in one LAN/one WAN

and one LAN/three WAN versions, the NETBuilder family supports wide area connections over ISDN, X.25, and Frame Relay. Unlike Digital's MultiStack, though, SuperStack takes up a twisted-pair port connection to connect to the rest of the stack.

SuperStack's AccessBuilder family



provides remote access for mobile clients and lets you manage the stack remotely using Transcend, 3Com's graphical SNMP software. Available with four or eight RS-232 connections, the AccessBuilder 2000 is easy to install and manage.



3COM'S SUPERSTACK includes units acquired from many vendors, and the Transcend package can manage them all.

Remote access is supported through the included Windows or DOS client software and any third-party PPP or SLIP package, including Win 95 and NT Remote Access Service.

And, like HP's AdvanceStack, 3Com's SuperStack provides RPS units, each of which can protect as many as four hubs in the stack.

Finally, for those running Token-Ring, SuperStack provides a similar hub solution to that described above, minus the switching and high-speed capabilities.

MELTING POT IN A STACK

Over the years, 3Com has acquired a number of networking companies. Following these acquisitions, management of various merged product lines has sometimes been an obstacle. Transcend, 3Com's umbrella management package, does an excellent job of bringing all of the management functions for each product under one roof.

Depending on the size and breadth of components installed in your network, 3Com offers several flavors of Transcend. First, the Workgroup Manager for Windows 3.0 is specifically aimed at SuperStack solutions, and is competitively priced at \$695. The Enterprise Manager for Windows, at \$2,995, manages the SuperStack as well as other 3Com products such as the LinkBuilder MSH chassis-based hub.

The Enterprise Manager is also available for Unix. Similar to HP OpenView, this high-end version of Transcend can be installed from a CD-ROM quickly and easily. The SuperStack suite of hubs is manageable over IPX or IP environments. Transcend auto-detects which protocol the management client is running and auto-discovers network devices and topology.

RMON support is built into each hub in the stack, allowing you to gather statistics at the port level. Information regarding excessive traffic and alarms can be gathered and thresholds configured, which builds you an early alert system. In contrast, both Digital and HP gather basic information such as packets sent, but they require you to install an RMON probe in the stack and purchase additional software to gather RMON statistics.

3Com's SuperStack family of hubs provides a solid networking strategy for small and medium-size networks. SuperStack's flexibility, ease of management, and standard RMON support enhance its low price per port.

SuperStack. 3Com Corp., Santa Clara, CA; 800-638-3266, 408-492-1790; fax, 408-764-7070; e-mail, info@3com.com; Web, <http://www.3com.com>.

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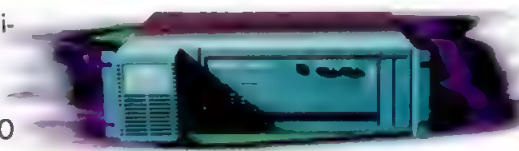
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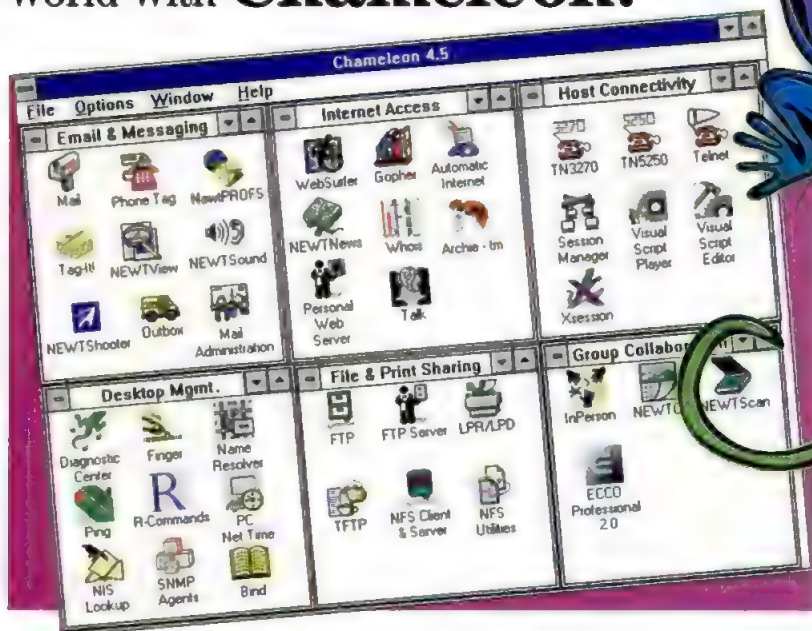
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First Looks

HANDS-ON REVIEWS OF NEW SHIPPING PRODUCTS

SERVER-BASED ROUTERS

WAN Routing the New-Fashioned Way with MPR

By O. Ryan Tabibian

Software-based routers have traditionally been considered softies when it comes to building a wide area network. In general, this category of routers has offered limited functionality and hasn't provided the same level of fault tolerance and reliability that more traditional standalone routers from vendors such as Cisco and 3Com do. But with the introduction of Novell's MultiProtocol Router (MPR), Version 3.0, this could all change. Novell has added some crucial features to this version of MPR, making it a no-compromise router that can fit any environment and will rival solutions from traditional router vendors.

MPR is a NetWare Loadable Module (NLM)-based software router that runs on either NetWare 3.12 or 4.1 file servers. Because MPR is a software-only router, Novell is able to maintain all the functionality of standard hardware- and software-based routers, while providing you with the flexibility of choosing your own hardware. MPR can be a particularly economical solution for NetWare sites because the software can be installed on existing NetWare servers.

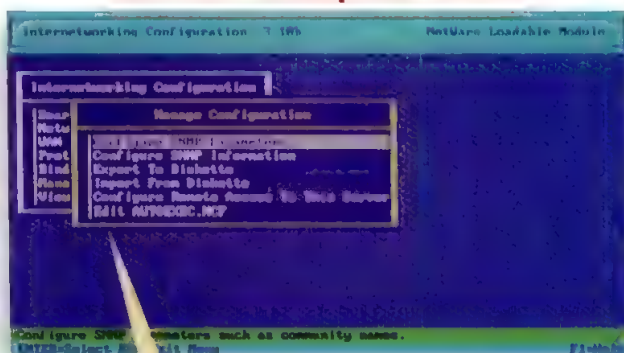
Though MPR has been around for several years, its lack of important features, such as support for Open Shortest Path First (OSPF) and dial-on-demand, has hampered its growth in the router market. But now that those features have been added, along with support for packet filtering and

compression, Novell is hoping to propel MPR forward.

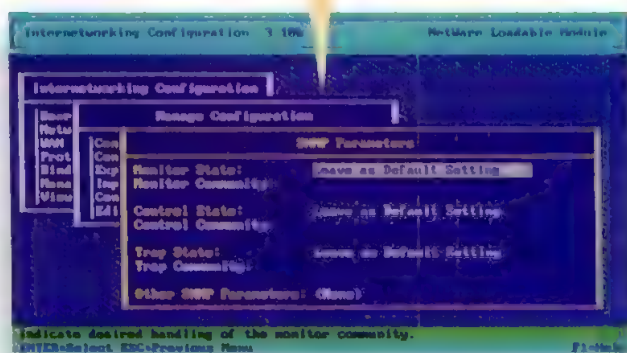
MPR is a two-pronged product; you can purchase either the \$995 NetWare BranchLink

Both incarnations of MPR also come with a two-user version of NetWare 3.12 and NetWare 4.1. And because Novell doesn't require you to buy a li-

NetWare Enterprise Router



C-WORTHINESS: Despite the C-Worthy interface, NetWare Enterprise Router is easy to install and configure.



Router or the \$2,495 NetWare Enterprise Router, which is what we reviewed. The products are identical in terms of features, except that NetWare BranchLink Router can only support 2 WAN ports, as opposed to the whopping 16 ports that Enterprise Router can support.

cense for each user, the Enterprise Router can be a very cost-effective solution.

Thanks to its intuitive installation routine and simple configuration menus, the Enterprise Router was easy to get up and running; it only took us a few moments. We were disappointed to find, however, that

Novell still depends on the dated C-Worthy interface rather than providing a graphical user interface for installation and configuration. Even with the C-Worthy interface, the product is much simpler to configure than the command line configuration of routers from Bay Networks, Cisco, or 3Com.

The product's most impressive feature is its support for Link State routing protocols like OSPF and Netware Link Service Protocol (NLSP). OSPF support is a particularly important addition because it is quickly becoming the de facto routing protocol over IP-based WANs. Users no longer have to maintain static routing tables or depend on less robust protocols such as RIP and SAP. And because OSPF is an industry standard, it provides compatibility with several other router vendors who support the protocol. NLSP, however, is a robust alternative to running RIP or SAP in IPX environments.

Dial-on-demand is another of Enterprise Router's attractive features that could prove invaluable to small offices with dial-up telephone or ISDN lines. With previous versions of this product, users either had to initiate a call manually or leave the line open, which resulted in expensive telephone bills.

With dial-on-demand, the router can open a call as soon as there is an outbound packet and terminate the call when there isn't any network traffic. This feature could not only save branch offices lots of money in telephone bills but could also make routing over dial-up lines much easier.

Enterprise Router uses the industry standard Point-to-

First Looks

Point protocol (PPP) for communicating over both digital and analog lines. Therefore, it can also support compression to help cut transmission costs further. This product doesn't support PPP or compression over either Frame Relay or X.25 networks, however. In fact, Enterprise Router doesn't support either Frame Relay or X.25 at all; in order to add this support, you will need the \$495

WAN extension pack.

To further enhance Enterprise Router's appeal, Novell has added a packet-filtering option to the product. Packet filtering works by checking each packet entering your network against an access control list that you create.

With packet filtering, you can perform many tasks normally associated with firewalls, such as creating access control

lists, blocking access to specific portions of your network, and logging all access to your internal network. The downside to this approach is that it creates more overhead on the router.

Novell has definitely elevated this product to a different level with Version 3.0. Given the impressive enhancements Novell has made to the product, Enterprise Router should

be a strong contender when deciding on a central site or branch office router, especially for Novell shops.

NetWare Enterprise Router, Version 3.0. *List price: \$2,495.*

NetWare BranchLink Router, Version 3.0. List price: \$995. Novell Inc., Provo, UT 84606-6149; 800-453-1267; fax, 801-429-5155; Web, <http://www.novell.com>.

Circle 971 on reader service card

DATA RECOVERY

We Can Rebuild It

By Steve Rigney

The network nightmare: "I'm afraid the data is gone, and isn't it a shame about that hard disk." Many a network administrator has been awakened, sweat-drenched, by visions of an ABEND or some other nasty error on their NetWare file-server console. Dozens of events—mechanical problems, power surges and failures, user errors—can cause you to lose your data or damage your file server's hard disk. Fortunately, with Ontrack Data Recovery for NetWare (ODR-N), you can rebuild both the disk and the data.

ODR-N includes a set of three utilities—NetFile4, NetScan4, and NetDisk4—that can revive or move your data from a damaged hard disk after almost any common disaster, except possibly a major fire or hurricane. It is the only product specifically designed to recover lost data, and not just do whatever is necessary to remount your volumes.

ODR-N retails for \$395 for the first server license. Up to ten additional licenses can be purchased at \$195 each. Other site licenses are available based on the number of servers you have. The program comes on a single high-density floppy disk and includes the NetFile4, NetScan4, and NetDisk4 NLM-based utilities.

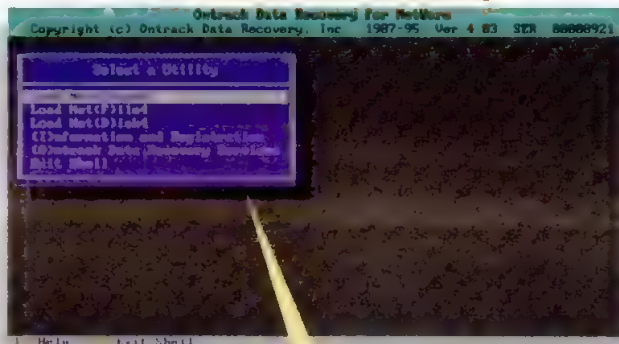
These utilities use a charac-

ter-based interface similar to the Btrieve DOS-based NetWare programs. The menus are extremely easy to use, and consequently you probably won't have to read the manual to perform most tasks.

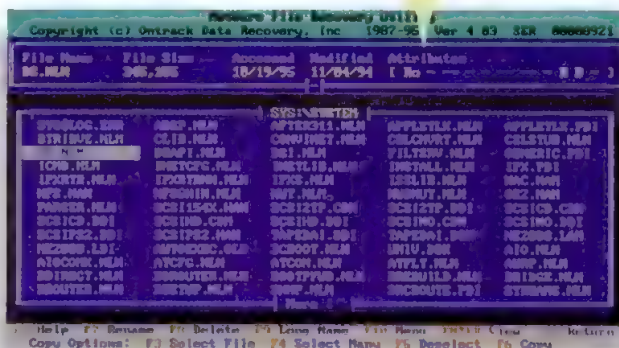
Of ODR-N's utilities, the most important is NetFile4. It lets you copy data from a damaged or dismounted volume to a DOS disk or NetWare volume on the same server or across the wire to another file

server. In our tests, we dismounted the volume on our NetWare 4.1 server and successfully copied all the data to a NetWare 3.12 volume on the same network. If you suspect that your hard drive or data is corrupted, this is a great way to backup information before you start repairs—an “after-the-fact backup.” Even if you had performed a backup the day before, you still don’t want to lose today’s work. Remem-

Ontrack Data Recovery



THE LAUNCH PAD: From Ontrack's main interface, you can launch any of the utilities, including NetScan4. With NetScan4, you can select from easy, manual, or report mode.



bering to use this utility before running NetScan4 or Novell's Vrepair to repair your damaged volume is crucial.

After it successfully copies important data to a safe location, ODR-N lets you repair the damaged information with NetScan4, another of the program's utilities. NetScan4 is designed to verify the integrity of your NetWare volume's file system and directory structure. It also allows you to scan your hard disks for any damaged sectors or bad blocks and redirect your data to a safer location on the disk.

Unlike Vrepair, which is designed to remount your volume—but not necessarily fix your data—NetScan4 won't change your data without creating a check file that contains the original data. If Vrepair finds any unallocated data, it may delete it so you can remount your NetWare volume. But with NetScan4, losing any data is highly unlikely, and at least you'll have a backup. While Vrepair is comparable to the DOS CheckDisk (CHKDSK) utility, NetScan4 is more similar to Symantec's Norton Disk Doctor. The first two simply clean up your hard disk so you can run the OS; the second two attempt to salvage damaged data.

Like the other utilities, NetScan4 offers different modes of execution. It has an Easy Mode, a Manual Mode, and a Report Mode. Easy Mode walks you through every step you need to take to perform a scan of your NetWare

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CIRCLE 929 ON READER SERVICE CARD

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First Looks

volume. Manual Mode allows you to select the steps you want to take. Report Mode keeps a log of all information and errors the program encounters.

If you are unable to communicate with your NetWare volume using the other two utilities but know what you're doing, you can use NetDisk4 to recover at least your most important data. In its simplest form, NetDisk4 is a disk editor that allows you to view individual sectors of your hard disk in decimal, hexadecimal, and ASCII format. NetDisk4 also lets you search for keywords or text, so that you can recover the most important information, such as the names in a database. In our tests, we used NetDisk4 to find a copy of our Master Boot Record

(MBR) and copy it to a floppy disk.

A good backup system is irreplaceable, and if you have the money, a RAID (Redundant Array of Inexpensive Disks) device on your file server is a great solution. But you can't back up your data all the time, and even one day's lost information can cost your company in terms of both money and effort. Ontrack Data Recovery for NetWare is an investment that, at only \$395, will pay for itself over and over.

Ontrack Data Recovery for NetWare List price: \$395. Ontrack Computer Systems, Eden Prairie, MN; 800-752-7557, 714-263-9245; fax, 714-263-9246; Web, <http://www.ontrack.com>; e-mail, sales@ontrack.com.

Circle 968 on reader service card

STORAGE MANAGEMENT

GroupStore's One-Tune Storage

By Steve Rigney

Who hasn't had to perform a fast cleaning job on an office or apartment? You have several places—a filing cabinet, a closet, a desk drawer—in which to store old magazines, bills you've been holding on to, important correspondence, and so on. But imagine how limiting, and potentially frustrating, it would be to have only one place in which to store such things—you need options.

On a much more complex level, you need the same flexibility when storing infrequently used or old data on your network. Most networks are composed of different NOS versions

and use a combination of optical jukeboxes, tape auto-loaders, and 4- and 8-mm DAT drives to store and archive data. Most HSM products, such as Cheyenne's HSM and Palindrome's Storage Manager, allow you the flexibility you need to choose where your data should be stored. But Imagery Software's GroupStore HSM, Version 1.5 (\$5,995 for a single-server license, \$11,995 for three servers), doesn't work that way.

Though the product has an intuitive interface and effectively transfers your old data, it runs only on NetWare 4.x file servers and allows you to move your data only to an optical jukebox.



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HP PowerWise UPS. Power management and power pricing finally meet.

In a perfect world, you'd have the time and resources to personally scrutinize network power, from start to finish. But in the real world, it's just one of many pressing concerns. That's why you need the perfect UPS. From ordering to operation, the HP PowerWise manages every last detail of network power. Leaving you free to keep your eye on the big picture.

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system configuration and ordering. Everything you need—hardware, shutdown software, management software, SNMP agent, and cables—comes in one neat package. And that package is priced up to 20% less than competitive solutions.

A running start.

Everything is designed for easy setup, so you'll be up and running in record time. A single CD-ROM provides one point of installation for all UPS management software (shutdown, OpenView, SNMP). What's more, utilizing HP OpenView, PowerWise even lets you configure and monitor multiple UPSs from a single screen.

Proactive protection.

And once PowerWise is on line, it provides reliable, unattended shutdown of server and network operations. It monitors and predicts battery failure in advance. It even gives you remote central management through a single OpenView console and remote paging capability. Plus, it includes inventory reporting capabilities that display all the vital statistics of UPSs on your network. All of which leaves you more time to deal with the rest of your demanding job.

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We even include a two-year express exchange service, and optional three-year on-site service is available.

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If you're also an HP NetServer customer, you get full integration with NetServer Navigator and NetServer Assistant. One phone call covers both your HP NetServer and HP PowerWise. If anything goes wrong with either, we'll fix it. Without wasting time on a lot of finger-pointing.

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* List prices as of October 1, 1995. † PowerWise Assistant; shutdown, management and diagnostics software for Windows NT and Novell Netware (other OSs available separately). © 1995 Hewlett-Packard Company. All rights reserved.

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NETWORK EDITION

First Looks

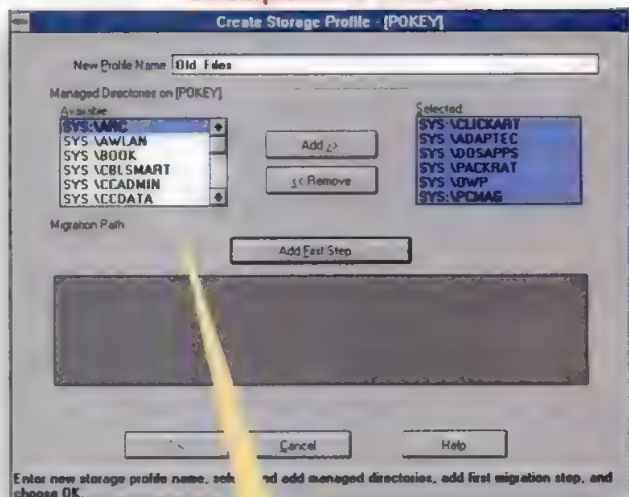
To its credit, GroupStore does allow you to choose a specific location on the optical jukebox's individual platters, but that doesn't make up for its general lack of flexibility.

GroupStore is also limited in terms of device drivers. While Cheyenne HSM and Storage Manager include their own sets of drivers, GroupStore uses the device drivers that come with NetWare 4.x, relying entirely on Novell HCSS (High Capacity Storage System) drivers to set up and communicate with your optical drives. (HCSS is a data storage system that extends the storage capacity of a NetWare server by integrating an optical disk library or jukebox into the NetWare file system.) But strangely, the GroupStore manual doesn't provide detailed information on how to set up and

configure HCSS; you have to dig up your NetWare 4.0 CD-ROM just to install the HCSS drivers. Installing and configuring our Conner optical jukebox using the HCSS software took about an hour. After we installed the optical jukebox on our Zenith Data Systems Z-Server, we were able to load the GroupStore software and successfully select the volumes and data we wanted to migrate.

Configuring retention rules, one of the most important features of any HSM product, is another area where GroupStore lags behind. Cheyenne HSM and Storage Manager allow you to choose the files you want to migrate based on date, size, owner, and even type of file. Unfortunately, the retention rules in GroupStore aren't so open—you can only

GroupStore HSM



SPARSE SELECTION: Currently, GroupStore allows you only to select specific files and subdirectories for migration, not individual files based on owner, date, or type.



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NETWORK EDITION

First Looks

choose to move or not to move individual files or subdirectories. Imagery says that more flexible retention options will be offered in Version 2.0.

Another of GroupStore HSM's shortcomings is the lack of a utility that will warn users when they attempt to access data that has migrated to an optical jukebox. Although optical jukeboxes are faster than tape auto-loaders, you could still wait several minutes before being able to retrieve a large graphics file that has migrated.

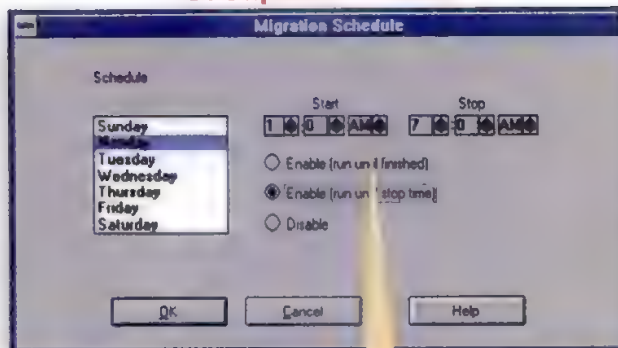
Despite its flaws, GroupStore does excel in a couple of areas. One is in its ability to add migration servers to the network. You can connect multiple optical jukeboxes to several servers on the network and use GroupStore to transfer data from one server to an optical jukebox located at another

location on the LAN.

Another area where GroupStore is strong is in its scheduled migration. Like most HSM products, GroupStore uses a series of "high-water" and "low-water" marks to keep the hard disk on your file server from overflowing. For example, your high-water mark might be at 80 percent of your hard disk's capacity and your low-water mark at 60 percent of capacity. You can schedule GroupStore to move available files automatically after hours or whenever you exceed your water marks. If you reach the high-water mark during office hours, GroupStore will automatically launch an emergency migration.

GroupStore offers a very intuitive interface and is easy to install, after you have tackled Novell's HCSS. Unfortunately,

GroupStore HSM



HEADED SOUTH: GroupStore lets you schedule data migration to occur automatically after hours when network traffic is light.

the types of storage devices you can use are limited, and until Version 2.0 is available, you don't have much control over the type of data that migrates or how or where it can migrate. Which is to say that waiting on Version 2.0 is prob-

ably a good idea.

GroupStore HSM. List price: \$5,995. Imagery Software Inc., 7 Oak Park, Bedford MA, 01730; 508-322-7300; fax, 617-280-9710; Web, <http://www.imagery.com>.

Circle 972 on reader service card

THE NETWORKER By Diane Danielle

Living-Room LANs Revisited



I've got some news if you think your home network makes you unique or even unusual. If the response to my April 11, 1995, column on living-room LANs is any indication, home networks may be the next big media story.

Most of you work in the computer industry. Some of you are novices, others go back to CPM. Almost all of you use Ethernet (coax or 10Base-T), although one of the most interesting networks runs on Arcnet. About half of you run peer-to-peer networks (LANtastic or Windows for Workgroups); the rest are using dedicated servers (mainly NetWare) or some combination. Your desktop computers are Macs, PCs and Suns. Linux is surprisingly popular (at least to this DOS person). Many of you are running multiple desktop operating systems; some of you are running multiple NOSs. Almost all of your nets have grown like crazy.

Ferdinand Velasco wins for "most unusual noncomputer occupation." He's a cardiothoracic surgeon who succeeded in connecting his two OS/2 machines with LANtastic for OS/2, although just about everything that could go wrong did. Jong H. Lee has the largest network: 10 computers running NTAS 3.5, NetWare 3.12, Linux 1.0, Windows for Workgroups, NT Workstation 3.5, Windows 95, and DOS.

Brian Peabody's self-proclaimed "baddest LAN in the sub-

division" shares the award for the most awesome cabling system. His three bedrooms, library/theater, and kitchen are wired, and all of his "central hardware is installed in an electronics bay with punch-down for telephone services, CATV distribution, intercom, and power supply for the alarm system." The cowinner, Ben (no last name), owner and operator of four medical clinics, wired all 24 telephone locations with four-pair phone cable and runs Arcnet over two of the pairs. With a remote-control mouse and infrared remote extenders, he can access his Caller ID program from any TV in the house.

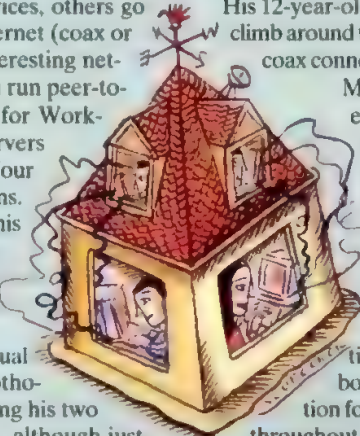
Paul Dubinsky uses coax that he's pulled through the floor. His 12-year-old daughter "grew up thinking it was normal to climb around the crawl space under the floor looking for loose coax connectors."

More on kids: Two-year olds appear to have an evolutionary affinity for buttons, especially the big red ones. Jim DeFrisco's DAT tapes turn up in his son's Lego box (little black buttons are attractive, too). Jong H. Lee's daughter can mouse her way to Lion King on one of his computer's menus but she can't—yet—simultaneously press the five keys it takes to escape from the menu.

John Curtis wins for the most unusual location. His network used to live on a 45-foot sailboat. And Alexander Auerbach has the best solution for home builders or remodelers: Run PVC pipes throughout your home.

Thanks for all your letters. I only wish I had more space to devote to your experiences with these amazing home networks.

Diane Danielle, an independent networking consultant, can be reached on CompuServe at 72241,2566 or MCI Mail at 383-1159.



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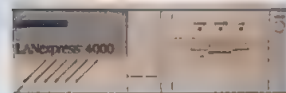
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New & Improved

NEWS OF ANNOUNCED PRODUCTS AND UPGRADES

By Eryn Brown

AmberSwitch Arrives

Ready to invest in a switch? If you're working on a budget, you may want to investigate **Amber Wave Systems'** AmberSwitch. Designed for workgroups, the Ethernet switch operates with all popular network protocols and desktop operating systems. You can configure the switch's ASIC through Amber Wave's SoftSwitch design, letting you keep up with software updates and standards. **AmberSwitch.** List price: With 8 ports, under \$2,000. **Amber Wave Systems Inc.,** Acton, MA; 508-266-2900; e-mail, info@amberwave.com; Web, <http://www.amberwave.com>.

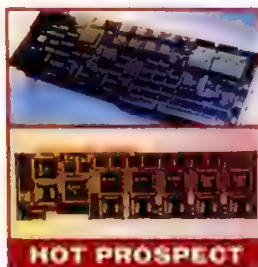
Circle 951 on reader service card



AMBER WAVE SYSTEMS debuts its 10BaseT and 10Base2 switches. 100BaseT will follow.

LANTastic for Windows 95 to Ship in 1996

LANTastic network clients will soon be able to take full advantage of Microsoft Windows 95. **Artisoft** is planning to ship LANTastic for Windows 95 during the first quarter of 1996. The new client software will allow Windows 95 PCs to share network resources with DOS, Windows, and OS/2 machines. The package also features new security and administration enhancements. **LANTastic for Windows 95.** Street price: Under \$100. **Artisoft Inc.,** Tucson, AZ; 800-233-5564, 520-670-7100; fax, 520-670-7101; e-mail, sales@artisoft.com; Web, <http://www.artisoft.com>. Circle 952 on reader service card



Telebit and Xircom Team Up for MICA

Finally, ISDN availability is becoming a reality, and not just from the telco side. **Telebit** and **Xircom** are joining forces to release an ISA card set that will provide high-density modem and Primary Rate ISDN capabilities, letting you originate and answer digital and analog calls, all from one device.

The card set, due to ship during the first quarter of 1996, is the first offering under Telebit's Modem ISDN Channel Aggregation (MICA) Developer Program. Telebit will provide technical and material resources to third-party vendors that develop products for the MICA architecture, which will combine digital and analog technologies in single, multifunction products.

In this case, the ISDN card will come from Xircom and the digital modem cards will come from Telebit. The digital modem cards are available with up to 30 modems on board. More products from these two companies should appear throughout 1996.

MICA Remote Access Solutions. List price: To be determined. **Telebit Corp.,** Chelmsford, MA; 800-835-3248, 508-441-2181; e-mail, info@telebit.com; Web, <http://www.telebit.com>. **Xircom Inc.,** Thousand Oaks, CA; 800-438-4526, 805-376-9300; e-mail, sales@xircom.com; Web, <http://www.xircom.com>. Circle 969 (Telebit), 970 (Xircom) on reader service card

New Features Grace Norton Backup Product

Hot on the heels of the product's initial release, **Symantec** is shipping a new version of Norton Enterprise Backup. Version 1.5 backs up NetWare, LAN Server, and Windows NT Advanced servers. It can also work with Windows 95, Windows NT, Windows 3.x, OS/2, and Macintosh clients. The upgrade adds a Verify Tape feature that employs algorithms to check that the backup tape is being written correctly.

Norton Enterprise Backup, Version 1.5. List price: Single Server Edition, \$795; Multiple Server Edition, \$1,395. **Symantec Corp.,** Cupertino, CA; 800-441-7234, 503-334-6054; Web, <http://www.symantec.com>.

Circle 953 on reader service card



NORTON ENTERPRISE BACKUP supports NetWare, LAN Server, and Windows NT Advanced Servers.

FirstClass Server: A Mac Staple Hits the PC

Although it's known for Macintosh communications products, **SoftArc** is moving into PC territory with FirstClass Server for Windows NT, an update of the company's four-year-old Macintosh server software. The product will supply all of the functionality of its Mac predecessor and will communicate with any FirstClass client (DOS, Mac, OS/2, terminal-emulation mode, or Windows), blending invisibly into existing installations. It can support more than 100,000 accounts per server and over 250 simultaneous network or remote connections.

FirstClass Server for Windows NT. List price: For five users, \$495. **SoftArc Inc.,** Markham, Ontario, Canada; 905-415-7000; fax, 905-415-7151; e-mail, info@softarc.com; Web, <http://www.softarc.com>. Circle 954 on reader service card

NETWORK EDITION

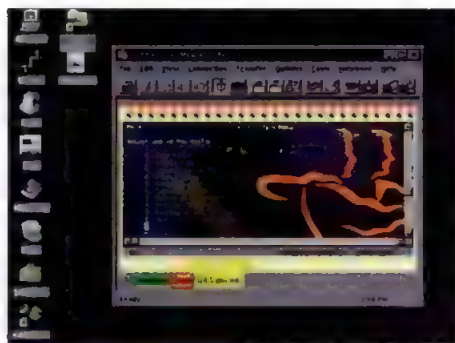
New & Improved

Application Metering Debuts from Horizons

Welcome the latest addition to **Horizons Technology's LANexpert!** software family. LAN-record is a metering and charge-back application that lets LAN managers meter resource usage. Using an NLM, the package can record use of applications, files, and disk space. You can set individual cost rates as needed. LAN-record also has its own reporting tools, as well as export capabilities. It is closely integrated with the LANauditor auditing and inventory software.

LANrecord, Version 1.0. List price: \$495; bundled with LANauditor, \$795. **Horizons Technology Inc., San Diego, CA;** 800-678-1097, 410-363-1097; fax, 410-363-3779; e-mail, info@horizons.com; Web, <http://www.horizons.com>.

Circle 955 on reader service card



RUMBA PICKS UP A NEW BEAT: Rumba Office 95/NT switches to a new 32-bit format.

Rumba: Where SNA and 32-Bit Windows Meet

Chances are you don't see a pretty face when you think about mainframe connectivity software. But **Wall Data** has released a new 32-bit client package, Rumba Office 95/NT, that might change that. Built on the company's existing software, the new product adds extensive help facilities and improved SNA over TCP/IP functionality. During installation, the program lets you choose to load either the Microsoft Windows 95 or the Windows NT version. The package features the new Rumba Notebook, an OLE 2.0 container that looks like tabbed pages, to help you complete and organize tasks.

Rumba Office 95/NT. List price: \$500. **Wall Data Inc., San Francisco, CA;** 800-915-9255; 415-856-9255; fax, 415-856-9265; Web, <http://www.walldata.com>.

Circle 956 on reader service card

BRIEFS

HARDWARE

A.T. Schindler Communications has announced availability of the FirLAN ET350 (\$4,995 and up) infrared transceiver. The ET350 comes in indoor and outdoor models and can transmit full 10-Mbps Ethernet up to 1,500 feet. It has a self-test mode and LED indicators. 613-723-1103.

LinkSys has introduced the Etherfast 100Base-TX Hub (\$1,999). The hub has 12 RJ-45 ports for Fast Ethernet, and works with Category 5 and STP cabling. Management features include 38 LED indicators. Also included are an auto-detecting power-supply feature, rack-mounting hardware, and two internal fans. 800-546-5797.

New Media Corp. has released three new PC Cards. The LANsurfer (under \$500) is a combined LAN adapter and V.34 modem. The 28.8 WinSurfer (under \$200) is a new data and fax modem with data throughput of up to 115.2 Kbps. The GAMEjammer is an 8-bit mono sound card with a built-in speaker. 800-453-0550

Physical Optics Corp. is shipping the POC Ethernet Extender System (\$2,490 and up). These boxes let you combine up to eight LAN segments on a single twisted-pair cable. The POC system is also available in a four-port model. 800-214-0222.

Shuttle Technology has announced an agreement whereby it will supply the EPAT ASIC for a new range of ComByte floppy disk and tape drives. 510-656-0180.

Tripp Lite is now offering the SMART DataCenter 3000XL (\$2,799) and the SMART DataCenter 5000XL (\$4,199). These uninterruptible power supplies both have 14 AC outlets, hot-swap battery capability, and expandable battery capacity. They also have four Db9 network ports, which means that the units can handle multiple-server shutdown with different operating systems. 312-755-5400.

Asanté Ships Bridge, Management Module

Fast Ethernet options continue to expand. **Asanté Technologies** is now shipping the AsantéFast 10/100 Bridge and AsantéFast 100 Management Module. The bridge works with all of the major network operating systems and has 2 ports, as well as an extra AUI port and diagnostic LEDs. The management module works with the company's 100Base-TX stackable hub. Both products are stackable and can work with existing 10-Mbps Ethernet equipment.

AsantéFast 10/100 Bridge. List price: \$1,395.

AsantéFast 100 Management Module. List price: Under \$2,000. **Asanté Technologies Inc., San Jose, CA;** 800-662-9686, 408-435-8388; fax, 408-432-7511; e-mail, sales@asante.com; Web, <http://www.asante.com>.

Circle 957 on reader service card



ASANTÉ now offers a Fast Ethernet solution for network bridging with its AsantéFast 10/100 bridge.

The Latest SecureLAN Security Products

Building on its certificate-based Secure Enterprise Architecture (SEA Stack) security technology, **Cylink** is following up its June SecureDomain release with two more SecureLAN family members: SecureManager and SecureNode. Just as SecureDomain sits between a subnetwork and a router and provides security for packets in that subnetwork, the SecureNode cards and units will sit in or outside individual nodes and provide security for those clients. SecureManager provides management across SecureLAN products.

SecureManager. List price: \$10,000. **SecureNode.** List price: To be determined. **Cylink Corp., Sunnyvale, CA;** 408-735-5800; fax, 800-735-6614; e-mail, info@cylink.com; Web, <http://www.cylink.com>.

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Dial-up

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Perle 833

Remote

Access

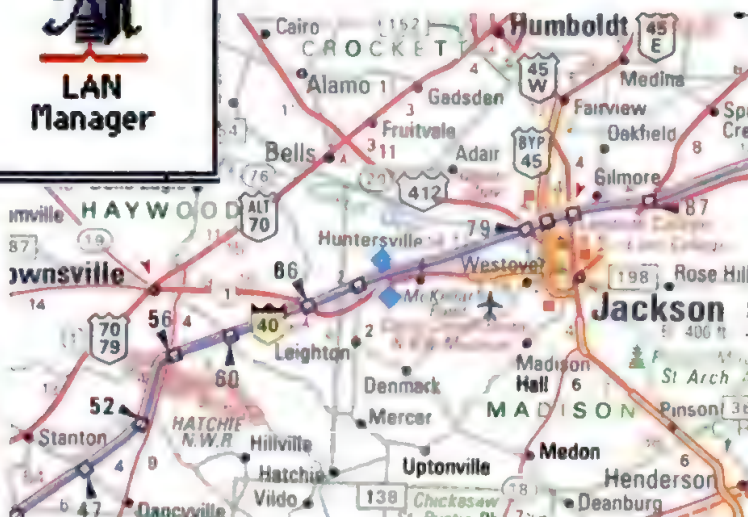
Server



Remote users need LAN dial-up access? The Perle 833 brings cost-effective remote access to your LAN from just about anywhere on the map. You'll get great performance, too! Standard features of the Perle 833 include:

- fast RISC architecture
- ISDN support for high-speed, low-cost data transfer
- port speeds of up to 115 Kbps
- available in 2, 4, and 8-port models to match your dial-up traffic.

Ideal for client/server applications and more! Remote DOS/Windows PCs appear as though they are a node on the Ethernet LAN, with all LAN resources available to the remote PC, including databases and e-mail. Even remote LAN administration is possible with the Perle 833. For reading and writing large blocks of data, simply launch a remote control session—popular third-party remote control software packages supported.



Secure your LAN. With four levels of security available, the Perle 833 is well-equipped to handle the most stringent security requirements.

Low-cost installation and maintenance. Easy set-up frees your time for more critical tasks, and configuration, monitoring, and software upgrades can be performed remotely, cutting travel and lost productivity.

Assistance just a call away. Help with installation and on-going operation is available, *at no charge*, by simply dialing Perle's responsive Customer Assistance Group.

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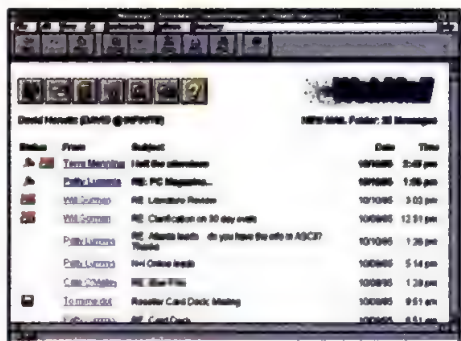
CIRCLE 928 ON READER SERVICE CARD



Infinite Technologies to Access Your E-Mail

Ever wanted to consolidate your e-mail and Web browser? Or do away with your laptop completely? **Infinite Technologies'** Connect2Voice and WebMail can help you out. WebMail lets you read your LAN e-mail through your favorite Web browser. You can use any computer with World-Wide Web access, regardless of platform. Connect2Voice provides e-mail access through the telephone, converting your messages from text to voice and depositing them into a phone mail system. It works with any Touch-tone telephone and can also function as a voice messaging system.

Connect2Voice. List price: For 50 users, \$3,999. **WebMail.** List price: For 25 users, \$499. **Infinite Technologies,** Owings Mills, MD; 800-678-1097, 410-363-1097; fax, 410-363-3779; e-mail, info@infinite.ihub.com; Web, <http://www.ihub.com>. Circle 959 on reader service card



WEB-SURF TO THE MAILBOX: Infinite Technologies offers two novel ways to check e-mail from a distance.

JVC's VIPSLAN-10: A Wireless LAN Made Easy

Ready to dive into the wireless LAN arena? **JVC Information Products** has introduced the VIPSLAN-10, a new modular infrared wireless LAN system. The package includes the Satellite, a ceiling-mounted unit that provides 360-degree connection (with a maximum radius of 5 meters); the Power Hub, Station, and Node for point-to-point connection; and the Mobile and PC Card for notebook connectivity. JVC also offers a T adapter, which you can use to plug directly into an existing Ethernet card or network hub.

VIPSLAN-10. List price: About \$190 per user. **JVC Information Products,** Irvine, CA; 714-261-1292; fax, 714-261-9690.

Circle 960 on reader service card

BRIEFS

SOFTWARE

cfSoftware is now shipping **pcMainframe**, Version 5.0 (\$11,500). The software enables easy data transfer between mainframes and PCs. New to this version are support for multiple file downloads, a new Host Initiation feature that lets you define and initiate transfers from the mainframe, and time-sensitive file protection. 800-366-8756.

McAfee has completed its acquisition of **Saber Software** and has announced its new combined product-line strategy. Users can expect to see more than ten announcements of new management products throughout the next year. The products will share data formats, a Microsoft Windows 95 interface, databases, and more. 408-988-3832.

NetPro's DS Expert for NetWare 4.1 (\$1,299) is now available. The utility product, the company's first for NetWare, will aid troubleshooting and optimization for NDS. The package has a Windows interface, which allows it to display multiple server information simultaneously. 800-998-5090.

ON Software has updated its **Meeting Maker XP** (\$1,139 and up) group scheduling and **SoftTrack** (\$595 and up) software metering applications. With Version 3.1, Meeting Maker now runs on Unix and OS/2 platforms. SoftTrack 2.7 adds functionality for metering mobile users, including the Check-Out feature, which eliminates the use of TSRs. 800-767-6683.

Funk Software has released **Appmeter 1.2** (\$595 and up), the latest update to its application-metering package. It is easier to install, since each Windows workstation no longer needs to be configured separately. Funk has also added support for NetWare 4.x. 800-828-4146.

Wavetek Reads Fiber-Optic Power Losses

When you're transmitting over fiber-optic cable, it's important to keep within the maximum power loss specs published with system and hardware requirements. **Wavetek's** new **FPC850KIT**, when used in conjunction with any digital multimeter, will let you keep tabs on power losses at all times. The kit ships in a sturdy case, and includes modules for an 850-nm light source and a power meter converter, as well as a launch cable with ST adapters, 9-volt batteries, and lens cleaner swabs.

Wavetek FPC850KIT. List price: \$799.95. **Wavetek Corp.,** San Diego, CA; 800-854-2708; fax, 619-450-0325; e-mail, bertzh@wavetek.com. Circle 961 on reader service card



CATCH THE WAVE: The FPC850KIT provides an easy way to monitor fiber-optic connections.

Telxon Delivers Mobile Wireless LAN Capability

One shortcoming of wireless LANs is that they often don't take advantage of one of the obvious benefits of wireless technology: mobility. But now, **Telxon** has introduced a mobile IP solution that will allow each user to move anywhere in a corporate location while maintaining a LAN link. The solution integrates software from FTP Software, access points from Aironet, and portable and pen-based computers from Telxon.

Integrated Mobile IP Option. List price: \$495 (access points). **Telxon Corp.,** Akron, OH; 800-800-8001; fax, 216-873-2058; e-mail, sales@telxon.com; Web, <http://www.telxon.com>.

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the competition fits." Furthermore, "If you have a fear of installing peripherals, you'll be glad to hear" EtherPower 10/100 has "the most user-friendly installation processor we've ever seen."

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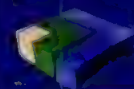
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If you've put together a small Web page, you know how tedious HTML tagging can be. **InfoAccess's** HTML Transit can simplify the process. Using new, template-based technology, the package lets publishers choose document appearance and behavior before it converts word processing files to HTML. Features include the ability to distribute a document across multiple files automatically and logically to make linking easier. HTML Transit works with the pending HTML 3.0 standard as well as display extensions for Netscape Navigator and other browsers.

HTML Transit. List price: \$495. **InfoAccess Inc.**, Bellevue, WA; 800-344-9737, 206-747-3203; fax, 206-641-9367; e-mail, info@infoaccess.com; Web, <http://www.infoaccess.com>.

Circle 963 on reader service card

BRIEFS

ANNOUNCEMENTS

Ameritech has released its Ameritech Electronic Sales Environment (ESE). ESE is designed to help manufacturers automate their indirect sales channels operations. Companies will be able to create an intuitive interface and provide immediate access to product literature, price lists, and availability information. 800-937-1373.

Sprint Business has announced the availability of a new, high-speed data service for IBM Systems Network Architecture (SNA) networks. Sprint is using a new Frame Relay Access Device (FRAD) to bring the service to businesses. 202-828-7410.

DynaTech Introduces New WAN/LAN Products

Here are a couple of products that should help you get your WANs going: **DynaTech Communications'** DynaStar 500 and DynaStar 150i. The DynaStar 500 is a LAN/WAN concentrator switch designed to extend network services to the outer edges of a WAN. It has one Ethernet port, three high-speed WAN ports, one low-speed async port, and five expansion slots for T1 ports, ATM, Token-Ring, or additional Ethernet ports. The DynaStar 150i is a multiple-line ISDN device for connecting LANs.

DynaStar 500. List price: \$7,000. **DynaStar 150i.** List price: \$14,980 and up. **DynaTech Communications Inc.**, Woodbridge, VA; 703-494-1400; fax, 703-494-1920; e-mail, maldus@woodbridge.dynatech.com; Web, <http://www.dynatech.com>.

Circle 964 on reader service card

MULTIPLE ACCESS By Frank J. Derfler, Jr.

The "Rise" of Telephony



Telephony. First, you have to pronounce it correctly. Say it like it's spelled: te-lef-in-nee. Second, you have to understand it. Telephony is shorthand for computer telephony integration, or CTI. It is the linking of telephones and computers together for enhanced productivity.

In early 1994 we thought that PC-based CTI (the stuff's been on mainframes for a decade) was going to be a hot growth area in the computer industry. But it hasn't been, and isn't. Whenever we see something cute and slightly familiar—like PDAs or smart phones—we suspend belief in the law dictating that technologies grow only from specific applications to general use. But wishing doesn't make it so. PC-based CTI has to spend time in the hot-house of corporate call centers before it moves to your desktop.

Corporate call centers, the workplaces of reservation clerks and 911 operators, are miserable places. These people work hard to please the hard-to-please. The "out-bound" call centers are more nefarious. These automated systems dial numbers until someone answers, then they buzz an idle clerk and make the phone connection. Do you get phone calls soliciting credit card and newspaper subscriptions during dinner? That's CTI at its most efficient. Ugh!

But the human spirit and intuition die hard. I still believe in this stuff, so I'd like to report on a few CTI products that I think are ready now.

It barely qualifies as CTI, but readers frequently ask about sharing a phone line between a fax machine, an answering machine, and a modem. The CommScan from Command Communications shares the phone line and also quickly converts your fax machine into a scanner—if you have a fax modem. It connects the fax machine to your fax modem so you can scan documents on the fax machine and capture them in your fax software. You can reverse the process and use the fax modem to send documents to the fax machine for printing. It's \$129.95. Contact Command at 303-751-7000 to find a dealer.

The AT&T Computer Telephone 8130 is a hardware and software system that works great by itself and serves also as the infrastructure for complex CTI applications. In a nutshell, you attach the CT 8130 to a PC's serial port, load the software, and have

complete control over calls, including logging them. It works with incoming Caller ID, conferencing, and lots of other features. The desktop phone has an LCD, a speakerphone, two phone lines, and all the standard business-phone features. I think this package, at \$199 list, is a big hit. Ask for it wherever they sell phones.

AnswerSoft has a Windows 95 app called Sixth Sense designed just for people developing CTI applications. Instead of starting at the ground floor, Sixth Sense allows you to establish rules that kick off actions, such as starting programs or making queries, in response to specific telephone connections or database query results. If a call center application is in your future, Sixth Sense makes it easy. Call AnswerSoft at 214-612-5100, or send e-mail to info@answersoft.com for more information.

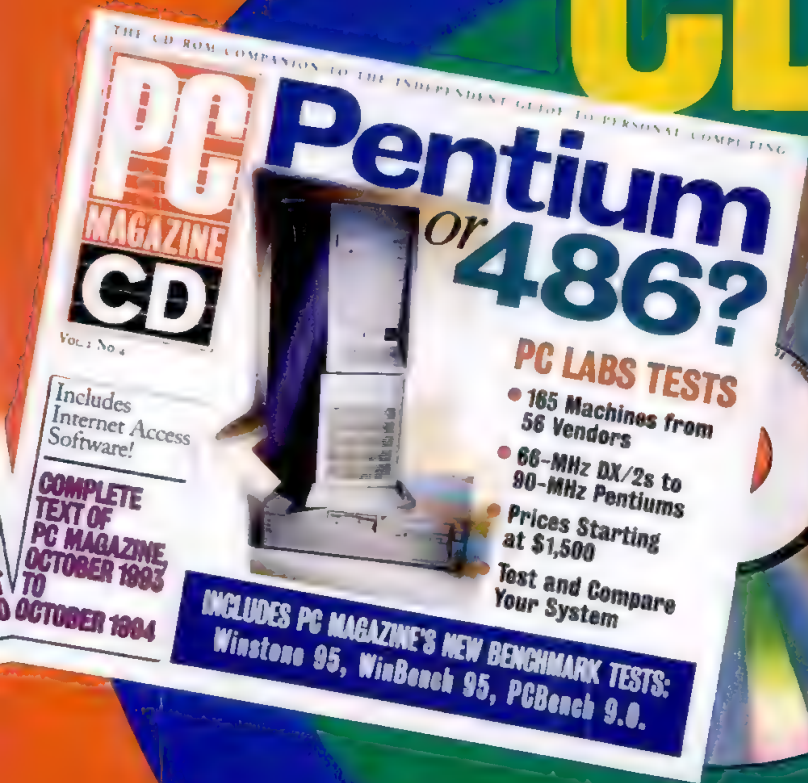
If you jump into telephony now, you still can consider yourself a pioneer—forging new paths in productivity!



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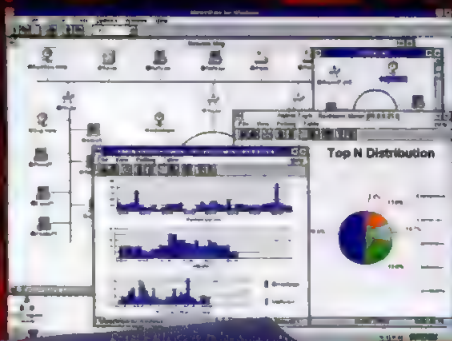
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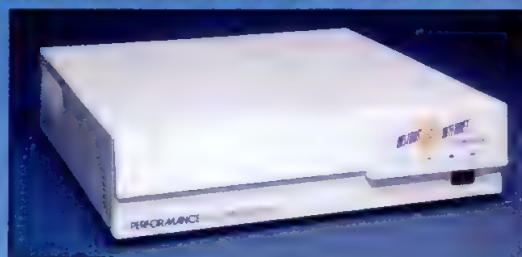
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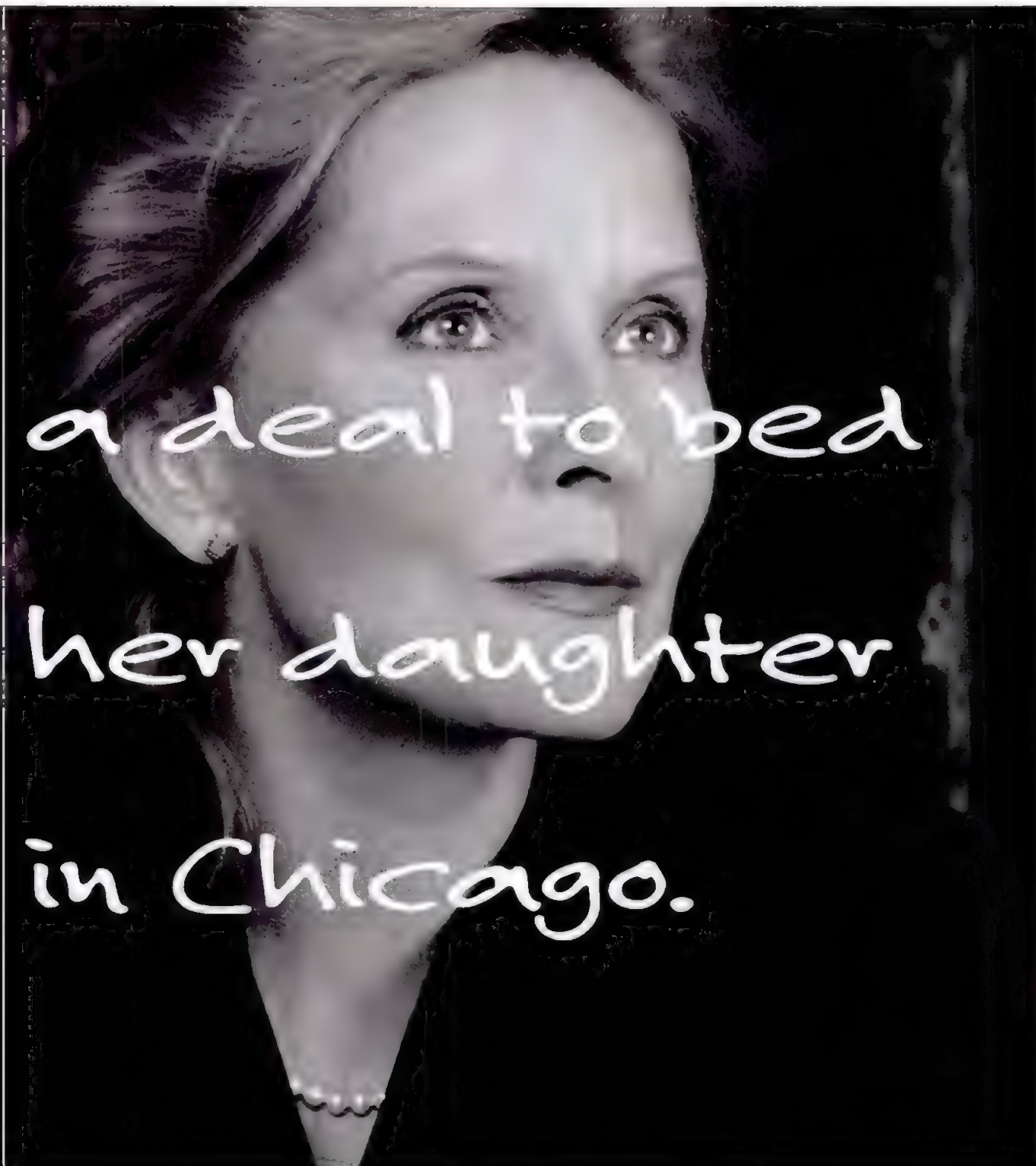


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How I spent my day getting nothing done, unless you count the 11 trips to the vending machine.

to sift through when all you wanted to do was pull together some facts and figures and create

some kind of meaningful report. So the fact that I

was getting nothing done made me edgy, which



meant a trip to the vending machine. D4. Cheese popcorn. And when 7 o'clock rolled around

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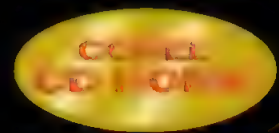
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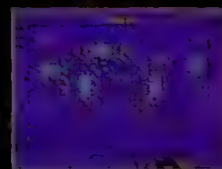
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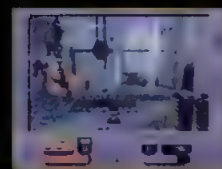
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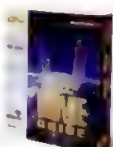
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By Michael J. Miller

THIS WAS THE YEAR WHEN PCs MADE FRONT page news, from the massive Windows 95 launch hype to lurid accounts of pornography on the Web. But the real news is still being made by engineers and programmers.

Here are the headlines: In the past year, the standard system has nearly doubled in speed and capacity; the standard operating system has become significantly more powerful, and the Internet has grown from the province of networking gurus and hackers to an information and marketing forum for millions. Behind these

stories are a host of great technologies and the people who created them.

In this, our 12th Annual Awards for Technical Excellence, we honor those technologies and their creators. A team of *PC Magazine* editors, writers, and labs staff considered thousands of entrants shipped from October 1, 1994, to September 30, 1995, to pick this year's selections. You can explore the winners and finalists on the pages that follow and, for the first time, in our virtual technical excellence awards gallery (<http://www.pcmag.com>).

Systems

Winner: IBM ThinkPad 760CD

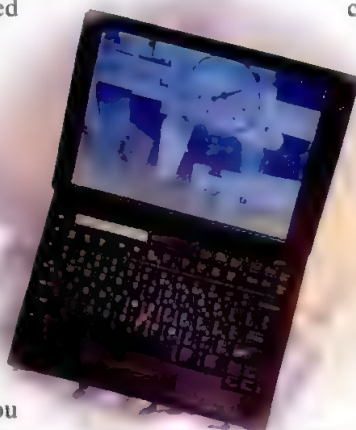
Koichi Higuchi, Yukifumi Nakazawa, Kenshin Yonemochi, Takashi Inui, Kanehide Ibayashi, Toshiyuki Ikeda



CONTINUING IBM'S TRADITION OF ground-breaking notebook innovations, the IBM ThinkPad 760CD broadens horizons for mobile executives. From its huge 12.1-inch Super VGA screen to its integrated quad-speed CD-ROM drive to its impressive video capabilities, the 760CD is the first notebook that can equal, and in some cases exceed, the abilities of a desktop PC.

The first thing you notice about the ThinkPad 760CD is its stunning 12.1-inch active-matrix screen, which offers about the same viewing area as a typical 14-inch monitor. Add in 800-by-600 resolution and the ability to display 65,536 colors, and you have a graphics workstation that fits in your briefcase.

The 760CD stands on the shoulders of its predecessor, the ThinkPad 755CD, the first mainstream



notebook with an internal CD-ROM drive. While continuing to use IBM's Mwave digital signal processor for the unit's modem and audio, the 760CD includes a quad-speed CD-ROM drive, video capture, and MPEG 2 playback. Because the CD resides in a bay that can accept other peripherals, there are actually a number of potential configurations, including one with two lithium ion batteries.

Powered by a 90-MHz Pentium processor, the 760CD proved a solid performer across the board on our benchmark tests; a 120-MHz version is on the way. All this fits into the same footprint as the 755CD and weighs in at 8.2 pounds.

By fitting a state-of-the-art desktop PC into a notebook, IBM stretches its technological lead in this highly competitive arena.

■ IBM PC Co., Research Triangle Park, NC; 800-426-2968.

Finalist: TI TravelMate 5000

The TravelMate 5000 Architecture and Development Team

TEXAS INSTRUMENT HAS LONG BEEN A LEADER IN high-end notebooks, and its TravelMate 5000 continues the tradition. One of the first notebook computers to contain a Pentium processor, it is a perfect desktop replacement that offers competitive speed and excellent battery life.

The TravelMate 5000 combines a 75-MHz Pentium processor with 256K of L2 cache. Full PCI support allows both internal and external components to take advantage of impressive bandwidth and performance.

The 7.2-pound machine also includes twin hot-swappable smart lithium ion batteries that use frontal LEDs to display charge levels. The TravelMate 5000 not only provides among the best battery life of any system we have tested, but easy battery handling as well.

If you are looking for a notebook with the speed of a desktop, the TravelMate 5000 sets the standard for many of today's best notebook features.

■ Texas Instruments Inc., Temple, TX; 800-848-3927.

Finalist: Toshiba Portégé 610CT

Gary Elsasser, Kenji Hibi, Kyoji Hayashi, Nobuyuki Tanaka, Brian Deeley

WITH THE NEW PORTÉGÉ 610CT, TOSHIBA CONTINUES to pack amazing amounts of power into incredibly svelte packages. This 4.8-pound machine measures only 8-by-10 inches but includes a 90-MHz Pentium processor, up to 40MB of EDO memory, nearly 700MB of hard disk space, two PC Card slots, and a 9.5-inch active-matrix color TFT display.

Compared with previous members of the Portégé family, the 610CT is not only faster but offers several novel features: a speaker, microphone jacks, and built-in sound controls that support MIDI and wavetable synthesis. It also incorporates design improvements that garner more power from its lithium ion battery.

It is a bit heavier and taller than previous models in the family, but it still provides the most power per pound of any machine we have seen.

■ Toshiba America Information Systems Inc., Irvine, CA; 800-334-3445.

Application Software

Winner: Microsoft Access for Windows 95

David Risher, Bob Gunderson, Chris Payne, Craig Unger, Frida Kumar, Gail Kulikowsky, Tod Nielson, John Betz



OVER THE PAST FEW YEARS, NO DESKTOP database has been nearly as innovative as Microsoft Access. The latest release—known as Access 95 or Access 7.0—includes new database creation, replication, and performance analysis tools, while offering vastly improved ease of use.

Access 7.0's most striking feature is its new Table Analyzer Wizard, which parses imported flat-file data and then suggests a normalized, relational table structure. This helps users design simpler, more efficient databases and will introduce many novices to the concepts behind the relational database model. Novices will also enjoy Access 7.0's ability to create background joins from within a wizard; once you describe the query result you wish, the Wizard figures out which fields, tables,



and joins are needed.

For more experienced users, Access 7.0 adds several query tools and a performance analyzer that suggests ways to speed up your database. It can tell you, for instance, where to add an index for the most efficient performance.

Replication has long been supported by server databases, but Access brings it to smaller settings. By exploiting hooks into the Windows 95's Briefcase feature, Access lets you easily replicate a database between any two machines, making it far easier to ensure that a copy of your data is current.

With improved ease of use, intuitive tools for building true relational databases from legacy flat files, and easy-to-use replication, Microsoft has extended Access appeal to neophytes and experienced database users.

■ *Microsoft Corp., Redmond WA; 800-426-9400.*

Finalist: Lotus Word Pro 96 Edition for Windows 3.1

John Throckmorton, Joe Guthridge, Bill Jones, Eliza Royal

RECOGNIZING THAT WORD PROCESSING IS OFTEN A collaborative, iterative practice, Lotus has incorporated team-computing support into its AmiPro software and rechristened it Word Pro 96 Edition for Windows 3.1.

This impressive new product includes a Team Review feature, which automates the distribution of documents for comments and editing, and a Team Consolidate feature, which lets you combine multiple files into a single document. New document control features let you specify user rights for all of your files; you can allow users to edit content but not design or even restrict them to mere annotation. Word Pro also includes versioning features that let you keep several incarnations of a document in a single file.

Word Pro has a number of other important new features, including on-the-fly spell-checking and an ask-the-expert help system.

■ *Lotus Development Corp., Atlanta, GA; 800-343-5414.*

Finalist: Microsoft Word for Windows 95

Jim Walsh, Michael Angiulo, Laura Burke, Raman Sarin, Randy Orrison, Steve Rayson, Dale Gipson, Joe Yap, Alex Mogilevsky, Ed Fries

SEEMINGLY SIMPLE CHANGES TO THE LATEST RELEASE of Microsoft Word may transform the way you use word processing. Microsoft Word Version 7.0 is a fully 32-bit application for Windows 95 that offers several unprecedented enhancements.

Word 7.0 will automatically underline your misspelled words as you type; spell-checking as we know it will never be the same. The most innovative new feature, however, is WordMail, which lets you use Word 7.0 as your e-mail editor. Your client must be Microsoft Exchange, but your e-mail compositions will always have the benefit of access to high-end word processing tools.

Word also makes use of many standard Microsoft Office features, including the ability to combine multiple files from different applications into a single document.

■ *Microsoft Corp., Redmond WA; 800-426-9400.*

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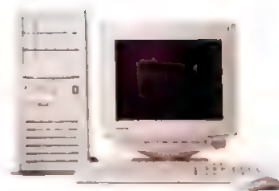
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Hard Drive	630MB or 1GB	630MB or 1GB	630MB or 1GB	1GB
Cache Internal	16KB	16KB	16KB	16KB
Cache External	256KB (optional)	256KB (optional)	256KB	256KB
Architecture	PCI	PCI	TriFlex/PCI	TriFlex/PCI
Video Memory/Max.	1MB/2MB	1MB/2MB	1MB/2MB	1MB/2MB
Compaq 150 Color Monitor	Yes	Yes	Yes	Yes
Diskette Drive	3.5" 1.44MB	3.5" 1.44MB	3.5" 1.44MB	3.5" 1.44MB
Expansion Slots (Total)	3	3	4	5
Drive Bays (Total)	3	3	4	5
Ports: Serial/Parallel	1/1 (ECP)	1/1 (ECP)	1/1 (ECP)	1/1 (ECP)
Security Features	Yes	Yes	Yes	Yes
Processor Upgradable	Yes	Yes	Yes	Yes
101-Key Keyboard, Mouse	Yes	Yes	Yes	Yes
Software Preinstalled (Choice of)	MS-Windows® 95 or MS-Windows 3.1	MS-Windows 95 or MS-Windows 3.1	MS-Windows 95 or MS-Windows 3.1	MS-Windows 95 or MS-Windows 3.1
Energy Star Compliant	Yes	Yes	Yes	Yes
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Peripherals

Winner: Snappy Video Snapshot

Paul Greaves, Tony Pabon, Dave Porter, Daniel Kaye



EVERY ONCE IN A WHILE, WE SEE A product so impressive, it makes us rethink an entire category. That was certainly the case with Play Inc.'s Snappy Video Snapshot, an inexpensive digital video capture device that produces images so good, you'd think they came from a very expensive digital capture board.

The 24-bit color Snappy images, which can achieve interpolated resolutions up to 1,500-by-1,125 pixels, look better than those from desktop scanners and most video capture boards.

What makes Snappy tick? The custom HD-1500 chip set designed by Play transposes the color space model inherent in the analog NTSC video source to the digital RGB format. Snappy can be attached to any analog video source, including your camcorder, VHS deck, TV tuner, and so forth.



While still subjects produce the best results, Snappy uses sophisticated software routines that stabilize moving images, letting you achieve astonishingly good capture results. It also allows you to adjust

color balance on the fly before you commit to a capture. Snappy's simple-looking software includes many other powerful technologies, including compensation for low light as well as chrominance and luminance delay and gain.

It all sounds complicated, but Snappy is incredibly easy to use. All users need to know is that they can grab images from video sources that look as good as photographs. At less than \$200, Snappy offers businesses an inexpensive source of digital images and provides an entry into digital photography for many people who would never have tried it before.

■ *Play Inc., Rancho Cordova, CA; 800-306-7529.*

Finalist: HP ScanJet 3c

The HP ScanJet Scanner Development Team

THE HP SCANJET 3C IS INDICATIVE OF THE RECENT and rapid improvements in scanning technology. A year ago, 24-bit, 400-dpi scanners represented the best option for mainstream users. Now products like the ScanJet 3c offer 30-bit, 600-dpi imaging that can yield interpolated results of up to 2,400 dpi.

The ScanJet 3c delivers extremely accurate color reproduction and the ability to resolve minute details and image highlights. It can accommodate everything from crisp line-art scans to photograph-quality, continuous-tone scans.

Not only does the ScanJet 3c offer controls for brightness, contrast, scaling, and sharpening, but its Twain-compliant driver can automatically locate an image on the scanner bed; detect whether it is black and white, gray scale, or color; and even half-tone the image during scanning. The HP ScanJet 4c, which shipped too late for this year's awards, follows closely in the ScanJet 3c's footsteps.

■ *Hewlett-Packard Co., Santa Clara, CA; 800-722-6538.*

Finalist: PowerDrive²

Toshikazu Yosumi

MULTIMEDIA IS NOW UBIQUITOUS, AND BACKUP IS AS important as ever. Panasonic Communications Systems Co.'s PowerDrive² is an ingenious device that gives you both. Using an implementation of phase-change recordable technology, the PowerDrive² lets you read traditional CD-ROM disks as well as read and write data on rewriteable 650MB optical disks.

Like magneto-optical (MO) technology, phase-change recordable technology lets you write information to an optical disk multiple times, a big advantage over write-once technologies such as CD-R. But phase change offers two big advantages over MO: It lets you read CD-ROMs, and it allows for direct overwriting of nonsequential data in a single pass over the data area. The combination of phase-change recordable and traditional quad-speed CD-ROM technology adds up to a tremendously useful device.

■ *Panasonic Communications Systems Co., Secaucus, NJ; 800-742-8086.*

Printers

Winner: Phaser 340

A.J. Rogers, Steve Palmquist, Ronald Adams, Meade Neal, Cliff King, Raul Krivoy, Richard Schmachtenberg, Clark Crawford, Pat Hacker, Jeff Clark, Ed Burke, Ronald Burr



THIS WAS CLEARLY A BANNER YEAR for color printers, and Tektronix's Phaser 340 solid-ink printer was one of the most exciting we saw.

The Phaser 340 takes the \$5,000 spectrum of the market in a new direction. Tektronix has taken an ingenious new approach to color printing, combining many of the attributes of solid-ink and laser-printing technologies to produce a machine capable of some of the most beautiful, photo-quality color output around.

The Phaser 340 uses solid-ink, or wax jet, printing. But unlike most wax jet printers, which spray melted wax directly onto paper, the Phaser 340 sprays the wax onto a drum, which then transfers the image onto paper, similar to a laser printer. The result is clean, 300-dpi color out-

put at speeds close to 4 pages per minute.

Yet The Phaser 340 still offers the convenience of a solid-ink printer: You simply slide colored wax sticks into place to print a rated 3,000 pages.

The \$4,995 Phaser 340 creates rich color graphics and gradient fills without bands, making it particularly appropriate for mixing color images with text. With Adobe PostScript Level 2 and PCL 5 support, Pantone color simulations, and a wide range of available networking interfaces, it also is a good match for both color professionals and mainstream business offices.

The Phaser 340 mixes the quality and convenience of wax jet printing with 4-page-per-minute speed, all at a reasonable price. The combination sets a lead that others are sure to follow.

■ *Tektronix Inc., Wilsonville, OR; 800-835-6100.*

Finalist: HP LaserJet 5Si series

Ormond Rankin, Melody Armstrong, Arun Gupta, and the Engineering Team at the Business LaserJet Division

JUST AS COMPETING PRODUCTS WERE BEGINNING TO catch up with Hewlett-Packard Co.'s existing high-end printers, the company introduced the HP LaserJet 5Si series. With print speeds of up to 24 pages per minute, this new line of networked departmental laser printers sets a new standard for the industry.

HP has also improved its Windows-based JetAdmin printer management software, which brings end users into the act with a graphical status display. New driver software supports features such as watermarks, thumbnail printing, and booklet printing.

The HP LaserJet 5Si line also raises the bar on paper-handling by offering a maximum capacity of 3,100 sheets and by providing a sorter/mailbox option; administrators will be able to separate print jobs into bins that are specific to each user or group of users.

With their impressive speed and paper-handling improvements, products in the HP LaserJet 5Si series take printing to the next level.

■ *Hewlett-Packard Co., Santa Clara, CA; 800-752-0900.*

Finalist: Optra+ family

Scot Edwards, Ben Streepey, Glenn Hudson, and the Lexmark Development Team

LASER-PRINTER RESOLUTION HAS BEEN INCREASING over the years, but Lexmark International takes it a big leap forward with its Optra+ family, the first line of mainstream printers to offer true 1,200-dpi printing.

Imaging at 1,200 dpi takes somewhat longer than imaging at lower resolutions, so the Optra+ printers give you the option of printing at the faster rate of 12 or 16 pages per minute at the now-standard 600-dpi resolution. Even at the full 1,200 dpi, however, they can still deliver an impressive 8 pages per minute. You get access to images that are clearer and livelier at print speeds that many lower-resolution lasers can't match.

The series starts with the Optra R+, which has a street price of only about \$1,400, and progresses up to the Optra Lxi+, a powerful, high-volume network printer. All four Optra+ models make printing at 1,200 dpi (a resolution normally associated with high-end image setters) affordable for a huge range of users.

■ *Lexmark International Inc., Greenwich, CT; 800-891-0331.*



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Networking

Winner: ForeRunner ATM Product Family

FORE Systems ATM Development Team



EVERYONE IS TALKING ABOUT ASYNCHRONOUS transfer mode (ATM), but FORE Systems has actually delivered results. Although ATM standards have yet to be finalized, FORE has already developed a family of critical ATM components and has pioneered such features as LAN emulation, switched virtual circuits, and traffic management.

FORE offers a complete line of ATM products that cover everything from the desktop to the WAN. Its ATM adapters currently use several technologies for a wide variety of bus types (including PCI, EISA, and SBus), while the ASX-200 ATM switch line provides workgroup and backbone models for ATM throughout the enterprise. If you wish to connect your legacy Ethernet, Token-Ring, or FDDI network to ATM, FORE also

offers a pair of LAN access switches.

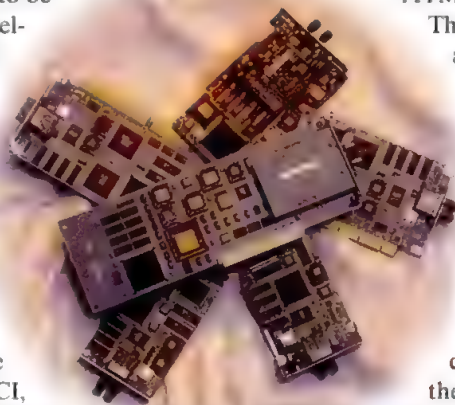
ATM is not just faster Ethernet; its switches and adapters require more powerful and complex software solutions. FORE led the way on the ATM software frontier with ForeThought, its configuration and management software suite. It is also the first company to support switched virtual circuits in both its adapters and its switches.

It will still be several years before you will have an affordable desktop solution that adheres to industry standards, but the ATM groundwork has been laid. As other companies begin to introduce their own ATM product lines,

FORE deserves recognition for its early work and its continuing commitment

to advancing the state of the art.

■ *FORE Systems Inc., Warrendale, PA;*
412-933-6244.



Finalist: WinFrame for Networks

Edward Iacobucci, Andy Stergiades, Brad Pederson

AMID THE FLURRY OF ACTIVITY IN THE REMOTE ACCESS industry, Citrix's WinFrame for Networks offers this year's most intriguing solution. It resides on a stand-alone Microsoft Windows NT Server and provides remote access to any Windows 3.1x or Windows 95 client/server application.

WinFrame, which typically connects to clients across a LAN or through a router to a WAN, supplies new levels of security, scalability, and manageability. The software is tightly tied into Windows NT's C2 security structure and is managed in detail by Microsoft's Systems Management Server.

WinFrame also includes Citrix's new Windows presentation services protocol, Intelligent Console Architecture, Version 3.0. Clients of all kinds, including Macintosh, Unix, and X Window, can now access Windows applications on the Citrix server.

■ *Citrix Systems Inc., Coral Springs, FL;*
800-437-7503.

Finalist: NetWare 4.1

The NetWare 4.1 Development Team

NOVELL HAS LONG BEEN A LEADER IN NETWORK operating systems, but the introduction of NetWare 4.1 has extended its leadership beyond file- and print-sharing into the backbone of enterprise-wide networking.

The key to this migration is NetWare Directory Services (NDS), a global and extensible directory service. Not only can you easily create a directory tree of network resource information, but third-party developers can write their own NDS hooks. While others have offered directory services in the past, Novell has gone the furthest toward delivering a solution that works in a global setting.

Other changes, such as hierarchical storage, compression, and better management tools (including NWADMIN), make this release of NetWare a strong network operating system. With improved manageability, better reliability, and the inclusion of NDS, however, NetWare 4.1 is a true standout.

■ *Novell Inc., Provo, UT; 800-638-9273.*

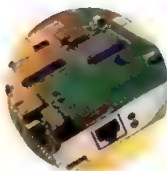


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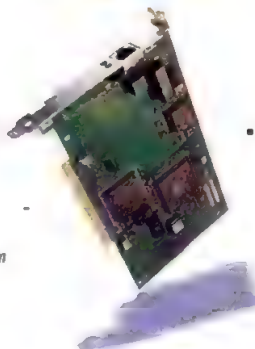
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Internet Tools

Winner: Java

James Gosling, Arthur van Hoff



JUST AS WE WERE BECOMING FAMILIAR with HTML-based World-Wide Web browsers and their static helper applications, Sun Microsystems' Java language ushered in a revolutionary new way to bring dynamic applications and true interactivity to the Web. Sun's HotJava Web browser, written using Java, already demonstrates the power of Java programs that migrate transparently across the Internet.

Today's browsers need built-in knowledge of the content they receive, an HTML page or .GIF image, for example. A Java-based browser doesn't need such built-in knowledge, since both the content and the means to play it are sent to the browser dynamically. The result is almost total freedom for developers, who can create any type of content they wish, even if it involves new standards or executable formats. The user on the Web gets the software pieces they need automatically when they access the page. Java-built Web pages can greet you, generate sound effects as you move

your cursor, play music, even display intricate animation. Java can also be used for commercial applications that carry out intricate financial transactions.

Java is a simplified derivative of C++ that was specifically built to be used in distributed environments. While it offers true object-orientation, it steers clear of complexities like multiple inheritance and offers such helpful features as automatic-garbage collection. Java is an interpreted, machine-independent language, so that any PC system with a Java-based browser can execute programs from any Java Web site.

The HotJava browser, available in an alpha release on Sun's Web site, fully supports Java, as does Netscape Navigator 2.0.

Soon, Java support will be even more common among Web browsers and Internet servers. Java, a visionary way to use the Internet as a pipeline for executable content, will transform the way we use the Web for years to come.

■ *Sun Microsystems Computer Co. (a unit of Sun Microsystems Inc.), Mountain View, CA; 800-786-7638.*



Finalist: Netscape Navigator 1.x

The Netscape Navigator Development Team

IN JUST OVER A YEAR, WORLD-WIDE WEB BROWSING has evolved from an imperfect, fledgling technology to a slick, ubiquitous pastime. Much of this quick evolution can be attributed to the Netscape Navigator 1.x series of browsers, which have garnered roughly 90 percent of the Web browser market.

Moving far beyond the original Mosaic implementation, Navigator supports newsgroups as well as http, ftp, and Gopher from the same window. More important, its support for enhancements to HTML, including new table features, has improved site design throughout the Web. Soon, most other Web browsers will follow the Netscape lead and begin adoption of the HTML 3.0 standard. Netscape Navigator is not intended for high security, but it does offer a basic level of protection that most competitors still do not provide.

Netscape has continually improved its browser throughout the year and kept it at the industry forefront. It was, for instance, among the first third-party browsers to work with Windows 95's Winsock stack. The latest version, Netscape Navigator 2.0, (which shipped about two weeks too late to be considered for our 1995 Technical Excellence award), incorporates many other enhancements, including Java language support and several new HTML features. Most notable, it offers the HTML frame method, which lets you divide your browser window into multiple sections.

Navigator has already set a new standard for browsing the Web, and Netscape's perpetual upgrades to the product continue to break new ground.

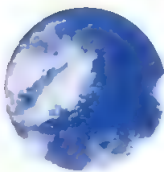
■ *Netscape Communications Corp., Mountain View, CA; 415-528-2555.*



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Winner: Microsoft Windows 95

The Windows 95 Team



NO PRODUCT RECEIVED MORE ATTENTION in 1995, and for very good reasons. While features like an object-oriented interface and support for 32-bit, multi-threaded applications have long been part of other operating systems, Microsoft Windows 95 builds an incredibly rich and productive environment on these well-tried foundations. The total package goes well beyond its predecessors, redefining what a personal operating system should be.

The user interface, centered around the Start button and Taskbar, sets a new standard for usability on personal computers. Beginners find launching and running multiple applications easy, while power users are always finding new ways to exploit its depth and customizability.

In addition to the core architectural features you expect in a modern OS, Windows 95 provides 32-bit support for all major PC networks and unrivaled tools for setting them up. Other standard features include mail, peer-to-peer networking, Internet con-

nectivity, remote dial-up and direct cable connectivity, file viewers, search utilities, and a solid set of system and administration tools.

Integrated Plug and Play, sophisticated hardware detection, and a huge collection of dynamically loadable 32-bit device drivers make setting up systems, installing peripherals, and adding networking significantly easier than anything we've seen on the PC. Windows 95 also inaugurates a number of important new initiatives through special APIs including integrated telephony (through TAPI), a unified inbox (through MAPI), and improved games support (through APIs such as DirectDraw).

Most impressive, it does all this while offering good performance on today's systems and a high degree of compatibility with existing 16-bit applications and device drivers. Every operating system design involves decisions and trade-offs, but the ones embodied in Windows 95 will make it the standard for a huge majority of the market.

■ *Microsoft Corp., Redmond, WA; 800-426-9400.*



Finalist: OS/2 Warp, Version 3

The OS/2 Warp Software Development Team

WHILE WINDOWS HOGGED MOST OF THE HEADLINES this year, IBM proved it could move quickly to advance its own personal operating system. Built on the robust 32-bit architecture introduced by OS/2 2.1, the new entrant offers a slew of new user-oriented features, support for Windows 3.1 applications, and a catchy new name: OS/2 Warp, Version 3.

OS/2 Warp brought many enhancements in its wake, but the real breakthrough was in connectivity. OS/2 Warp was the first mainstream operating system to include built-in Internet access as a standard feature. In addition to dial-up Internet connectivity, OS/2 Warp provides SLIP access and a full set of tools, from a browser to a mail reader. The IBM Internet Connection for OS/2 is part of the BonusPak for OS/2, included with every copy of OS/2 Warp.

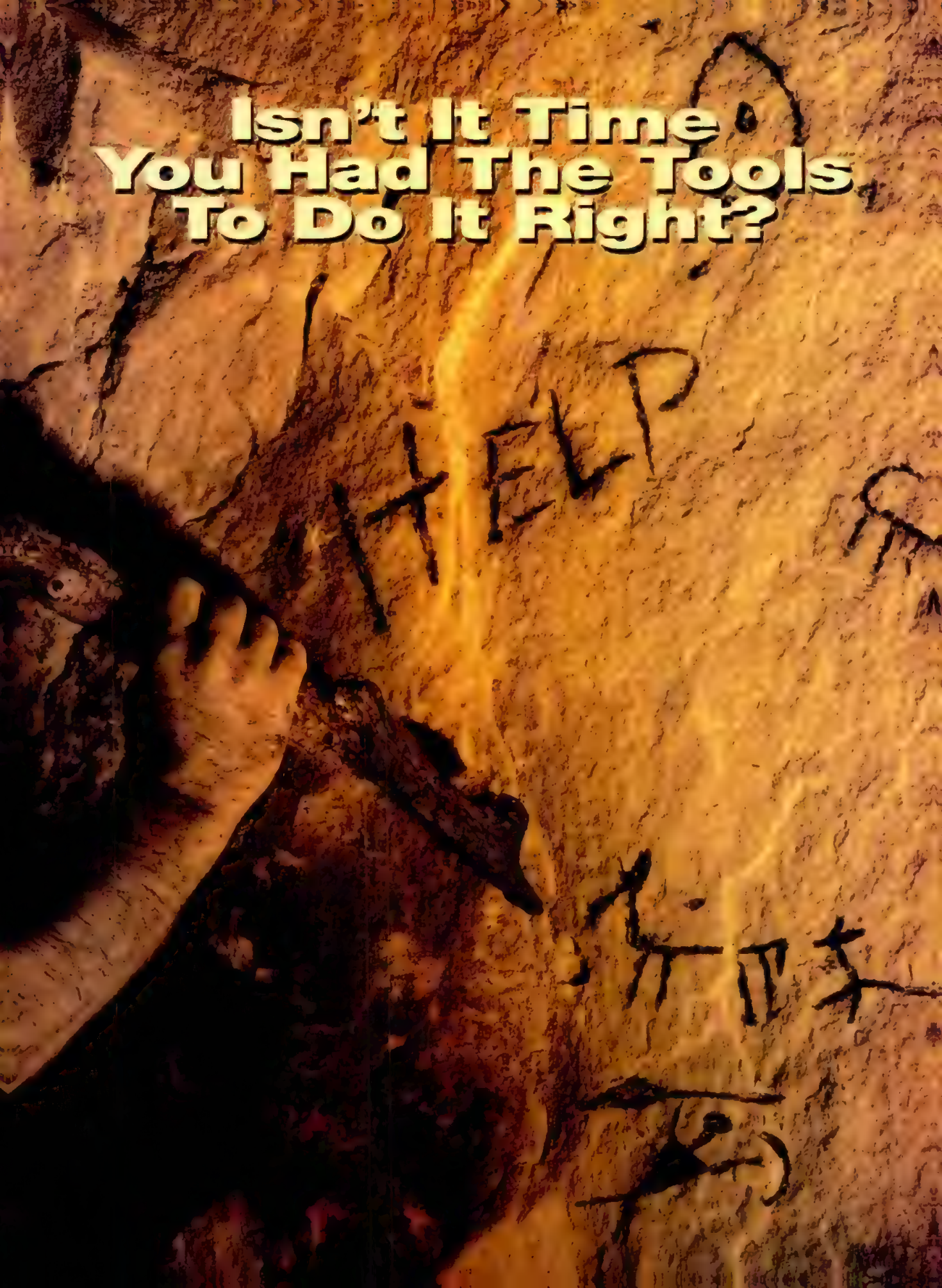
OS/2 Warp also brought big changes to the look of

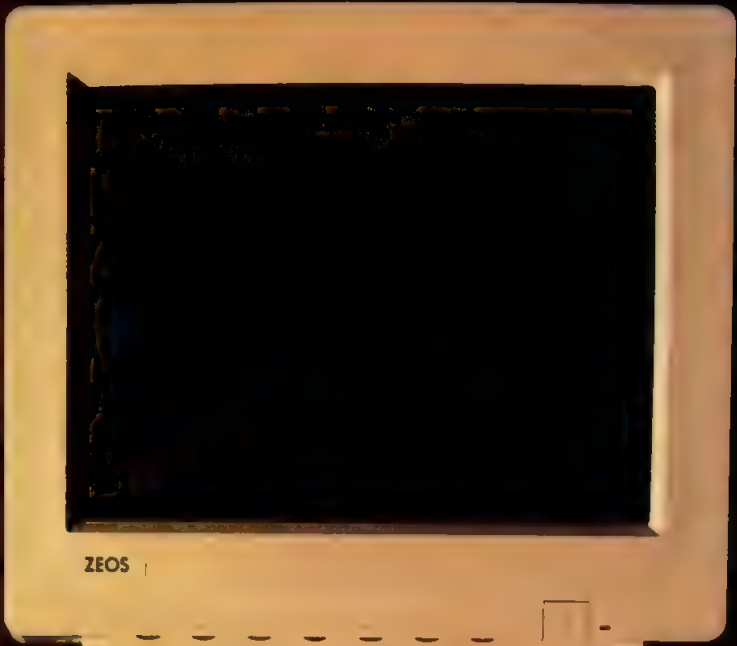
the Workplace Shell interface. Improvements such as the new LaunchPad, a customizable icon palette you can use to launch applications and documents, are welcome and worthwhile.

OS/2 Warp is available in two releases, one with built-in support for Microsoft Windows 3.1 applications and one designed to be installed over an existing copy of Windows 3.1 or later. A later version, OS/2 Warp Connect, also impresses us with built-in connectivity to a large number of networking operating systems, from peer services to IBM LAN Server to NetWare. Internet access and network connectivity have since become standard features of personal operating systems, but it was IBM's OS/2 Warp that first staked out this vital new territory.

■ *IBM Personal Software Products, Austin, TX; 800-342-6672.*

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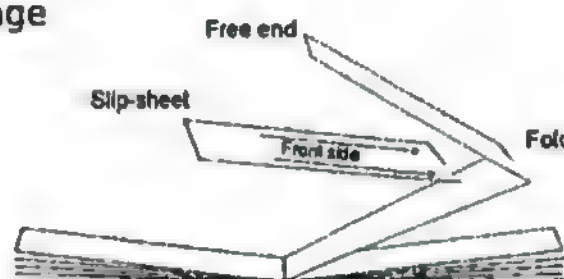
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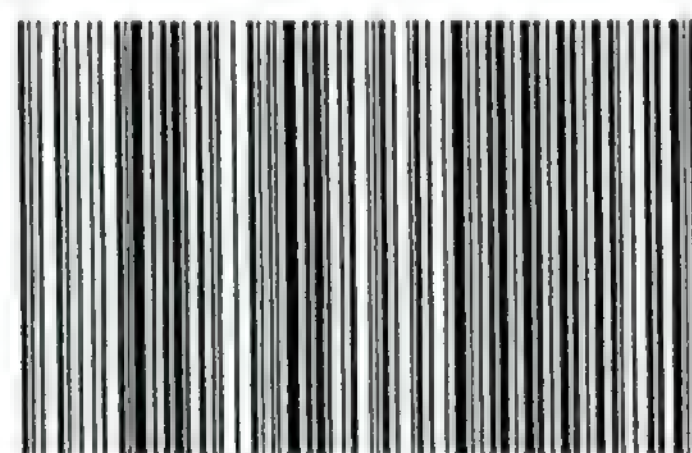
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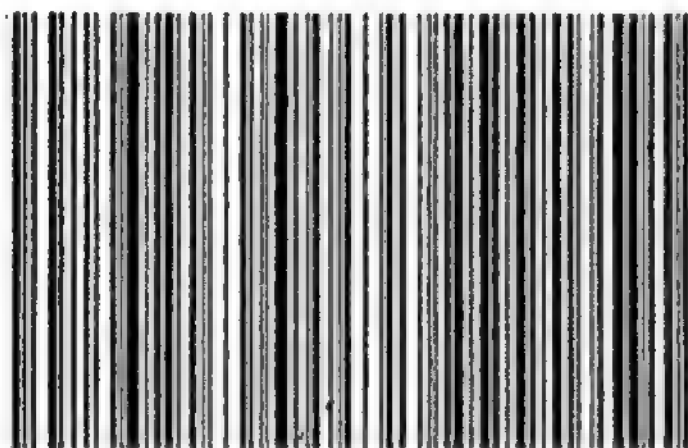
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CIRCLE 155 ON READER SERVICE CARD

Development Tools

Winner: Borland Delphi Client/Server

Anders Hejlsberg, Gary Whizin, Charles P. Jazdzewski, Allen Bauer, Zack Urlocker, Marc Cousineau, Bill Weber, Mark Sikes

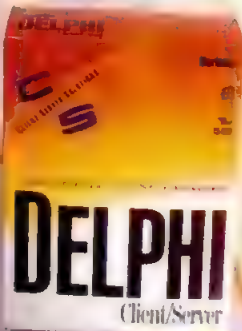


JUST WHEN RAPID APPLICATION DEVELOPMENT (RAD) tools were all starting to look the same, Borland Delphi came along and shattered the mold.

Delphi was the first visual programming tool to combine a true, native-code compiler with RAD-style on-the-fly coding, testing, and debugging. The hybrid lets you create small, fast executables and dynamic link libraries (DLLs) with the ease you'd normally associate with interpreted tools.

Delphi also brings Borland's object-oriented philosophy to visual programming. Its object-oriented dialect of the Pascal language lets you implement a true OO design with full inheritance, encapsulation, and polymorphism. At the same time, Object Pascal helps take the terror out of these esoteric concepts. As a high-level English-like language, it offers a more shallow learning curve and far fewer opportunities for error than C++ development systems.

The product ships with a rich set of Windows



components, and you can easily build your own and add them to your component palette for reuse. Delphi can also wrapper Visual Basic custom controls (VBXs), so you can use them in your projects

and even subclass them. The Client/Server version of Delphi adds SQL database connectivity, Borland's InterBase local SQL database engine, team development features, and other essentials for client/server programming.

Delphi, by combining the simplicity and ease of use of visual RAD tools, the power and speed of an optimizing compiler, and the elegance of an object-oriented language, sets a new standard in applications

development. Its strengths are well suited both to database programmers and developers of general-purpose applications. It is the most important new paradigm since the introduction of visual programming itself and one that other tools vendors are sure to follow.

■ *Borland International Inc., Scotts Valley, CA; 408-461-9195.*

Finalist: Microsoft Visual Basic, Version 4.0

Jon Roskill, Chris Flores, John Norwood, Chris Dias, David Holmes, Lisa Holcomb, Geoff Shilling

MICROSOFT VISUAL BASIC (VB) HAS LONG BEEN A wellspring of great innovations, and the latest version, 4.0, is no exception. This impressive new release is the first tool to introduce substantial OLE programming capability—including trail-blazing remote OLE automation—to the world of rapid application development.

Using VB, programmers can easily package their code as OLE automation objects that expose methods and properties through a standard OLE interface. These objects can be used (and reused) in VB and in other OLE-enabled applications such as word processors or spreadsheets.

Remote OLE automation, which anticipates the distributed OLE capability slated for Microsoft's Cairo operating system, lets you physically divide application components among networked systems.

This technique, called application partitioning, lets developers put business rules and similar components on separate servers where they can be easily maintained or upgraded. While some will argue that distributed OLE should be an operating system feature, VB's version is here today, and it works.

The new release of Visual Basic also introduces OLE custom controls (OCXs), an OLE-based successor to the wildly successful, widely adopted VBX format used in previous versions of Visual Basic. Even the VB environment itself exposes an OLE interface, making it easy for third parties to integrate add-ons such as version control packages. By making OLE the cornerstone of a RAD tool, Visual Basic 4.0 significantly enlarges programmers' horizons while easing their burdens.

■ *Microsoft Corp., Redmond, WA; 800-426-9400.*

Design

Winner: IBM TrackWrite keyboard

Nick King, John Karidis, Larry Stone, Michael Goldowsky, Gerry McVicker

FEW ADVANCES IN SYSTEM DESIGN WERE as surprising, yet so obviously right, as the expanding keyboard on the IBM TrackWrite. The first time we opened the machine, our reaction was an astonished grin: How did they ever get a full-size keyboard into such a small package?

The answer: the TrackWrite keyboard, an innovative design that splits the keyboard into two pieces that automatically slide into place when you open the case. This makes it possible to feature a full-size 85-key keyboard with standard 19-mm keycaps on a machine that's only 9.7 inches wide—just the width to accommodate the TrackWrite's 10.4-inch (diagonal) active-matrix 256-color display. Other advanced features include integrated 16-bit audio, PC Card support, and up to 720MB of disk storage.



The TrackWrite keyboard is slick, innovative, and useful. Most impressively, the sliding mechanism proved to be surprisingly durable, despite being a lot more complex than the standard keyboard. When open, the keyboard overhangs the case by about an inch on each side. When you close the lid, it divides and retracts smoothly into the case.

With larger displays coming on the market, their width rather than that of the keyboard may become the gating factor behind the overall design. Indeed, folding keyboards seems destined to be a short-term solution. But what an elegant solution it is, and one that shows that, when it comes to system design, first-class engineering still has plenty of elbow room to maneuver.

■ IBM PC Co., Research Triangle Park, NC; 800-426-2968.

Finalist: Acer Aspire

Acer America Corp., in conjunction with frogdesign inc.

ACER AMERICA'S ACER ASPIRE LINE OF DESKTOP and mini-tower PCs stakes a strong claim to having the best design of any consumer-oriented PC we've seen to date. While Acer doesn't change the basic form factor of the PC, its unquestionably offers the most unusual, stylized and handsome systems of the year. Cases, keyboards, and monitors come in emerald or charcoal, with elegant lines and aggressively rounded corners. The vent holes in the mini-tower unit look like they were made by a couple of shotgun blasts.

But the design, by frogdesign inc., is more than just a pretty face. It includes a number of usability enhancements, such as a snap-on keyboard palmrest. The bold Acer Aspire design can be found on a series of desktop PCs, minitowers, and monitors, which are available in a wide range of internal configurations targeted at consumers. All share the handsome architectural features that make the Acer Aspire a pleasure both to look at and to use.

■ Acer America Corp., San Jose, CA; 800-733-2237.

Finalist: Logitech MouseMan Product Family

The MouseMan Product Line Development Team

THE MOUSE HAS BEEN WITH US FOR A LONG TIME now, yet we continue to marvel at the new directions in which pointing-device designs are moving. In today's graphical world, the way we point and click at elements on the screen has become a matter of personal preference.

No company has broken more ground in this field than Logitech. Almost every year, it comes up with new and unique concepts in pointing devices. Most recently, Logitech created the MouseMan Sensa, the mouse with four unique case designs, and the TrackMan Marble, the unique trackball that incorporates technology to counteract the effects of hand oils that make other balls slip. Logitech has also pioneered such innovations as the wireless MouseMan Cordless, the MouseMan Lefty, and the 3-D Mouse. Logitech products not only work well, they look wonderful.

■ Logitech Inc., Fremont, CA; 800-231-7717.

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What's more, the new TI Extensa 550 uses the same PCI circuitry found in most desktop models for blazingly fast video monitors and improved disk drive performance. The new TI Extensa 550 also comes with a serial infrared port, which lets you print or share files, wirelessly. Thus enabling the new TI Extensa 550, and its owner, to do some extraordinary things.

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CIRCLE 353 ON READER SERVICE CARD

After Hours

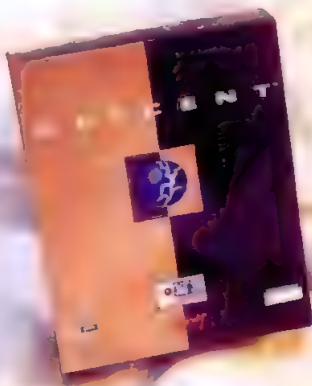
Winner: Descent

Mike Kulas, Matt Toschlog, John Slagel, Che-Yuan Wang, Adam Pletcher, Mark Dinse, Mark Allender, Jasen Whiteside, Rob Huebner, Rusty Buchert



WITH ITS UNPRECEDENTED 360-DEGREE range of motion, Interplay Productions' *Descent* takes first-person action gaming to the next echelon. Like id Software's *DOOM*, last year's Technical Excellence Award winner, *Descent* uses a three-dimensional environment, texture mapping, and light-source shading. But while most games in the *DOOM* genre restrict you to simple movement back and forth, the developers at Parallax Software, which developed *Descent* for Interplay, have provided for movement along any axis.

Each of *Descent*'s thirty levels is a maze of mine shafts that extend into multiple planes. As you career through this intricate world, up may become down, and left may become right. This kind of travel provides an extra jolt of realism—to the point that it be-



comes extremely disorienting and occasionally dizzying. Should you lose your sense of direction, a unique 3-D automap feature helps you reorient yourself with a keystroke.

Descent's added freedom of movement doesn't get in the way of other enhancements. You also get vivid visuals, fast speeds, and multiple-player gaming. As *Descent*'s impressive graphics engine keeps up a pace that rivals *DOOM*, you can compete against up to seven other players over an IPX network or have a dizzying remote tête-à-tête via modem link.

Several other companies have already shipped products with similar ranges of motion,

but Interplay and Parallax deserve recognition as pioneers of this action-game breakthrough.

■ *Interplay Productions Inc., Irvine, CA;*
800-969-4263.

Finalist: Flight Unlimited

Seamus Blackley, Wes Carroll, Doug Church, Tim Day, Rob Fermier, Andrew Haydn Grant, Ed Kim, Marc LeBlanc, Fred Lim, Greg Travis, Eric Twietmeyer

IN THE EVER-EVOLVING WORLD OF FLIGHT-SIMULATION software, Looking Glass Technologies' *Flight Unlimited* has upped the ante yet again with its revamped flying model and vivid graphics. Its virtual planes have finally discarded table-based flight modeling, which has plagued simulators since the days of the 8-bit Atari and the Commodore 64.

Since Looking Glass incorporates true physics-based paradigms into its models, these planes behave more like real aircraft than any simulator we have seen. Not to be outdone aesthetically, *Flight Unlimited* also boasts photo-realistic, texture-mapped graphics that are even more stunning than those in Microsoft *Flight Simulator*, a finalist in last year's Technical Excellence Awards. With its dynamic flight model and impressive graphics, this is the simulator by which all others will be judged.

■ *Looking Glass Technologies Inc., Cambridge, MA;*
800-360-7455.

Finalist: Star Trek: The Next Generation Interactive Technical Manual

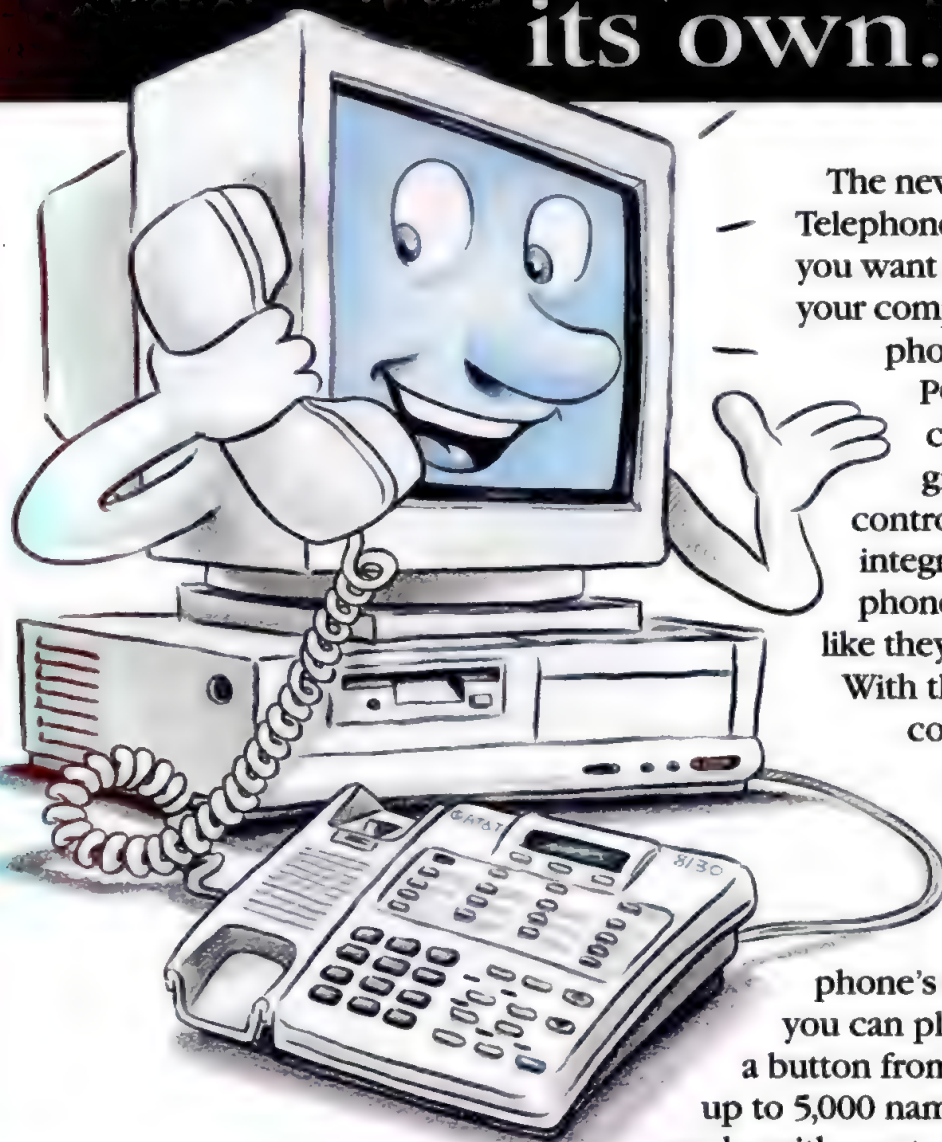
Keith Halper, Mike Okuda, Rick Sternbach, John Knoll, Eric Zarakov and the Apple Advanced Technology Group; Peter Mackey and the Imergy Software Development Team

SIMON & SCHUSTER INTERACTIVE'S *STAR TREK: The Next Generation Interactive Technical Manual*—the first implementation of Apple's QuickTime VR—uses this new technology to develop a virtual version of the U.S.S. Enterprise. Through the wonders of QuickTime VR, the manual will take you where no Trekkie has gone before.

At a time when stunning graphics and virtual realities are becoming major facets of software development, Apple's QuickTime VR lets you easily create your own photo-realistic worlds. You can build navigable, three-dimensional panoramas that don't require virtual reality peripherals from basic resources such as scanned photographs and software-rendered images.

■ *Simon & Schuster Interactive, New York, NY;*
800-910-0099.

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^{**}Supports Microsoft[®] TAPI specification.

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Person of the Year

Brad Silverberg and the Windows 95 team



THERE'S NO QUESTION THAT WINDOWS 95 has attracted more attention than any other software product. It seemed like much of the PC industry spent the first eight months of this year doing nothing but waiting for its arrival.

If it got here a lot later than many people had hoped, it was in part because of the many contradictory demands on the product. On one hand, Windows 95's core vision was to take the features of advanced operating systems, such as true 32-bit applications, multitasking, and multithreading, and bring them to the mainstream PC market. On the other, Windows 95 needed to be as compatible as possible with a huge installed base of 16-bit applications and legacy device drivers. Just as important for its ultimate success, it had to work credibly and perform comparably with Windows 3.1 on a modest hardware platform.

Given all these goals, just getting the operating system out the door was a major achievement. But the Windows 95 team delivered a product that not only met our basic expectations for a new operating system but went well beyond them.

The credit goes to Brad Silverberg, senior vice president of Microsoft's Personal Systems Division, and to the rest of the Windows 95 team. Since the project started in 1992 as Chicago, it went through numerous changes, from the addition of features such as Plug and Play to the creation of a slick new



user interface, best symbolized by the Start button in the lower left hand corner of the screen.

Silverberg and his lead developers, headed by David Cole and John Ludwig, spearheaded the effort of creating the product, adding the features, and making the necessary trade-offs between new features and compatibility.

Other members of the team were responsible for testing the product and writing documentation. General manager Brad Chase oversaw the phenomenal marketing effort, which seemed at times to surprise even the most laid-back Microsoft veterans.

Silverberg, who came to Microsoft in 1990 after a long stint at Borland to head the personal systems division was responsible for overseeing all these groups and pulling them all together to create Windows 95.

From the time Chicago was first publicly announced in late 1993 until Windows 95 shipped in August of this year, every change was scrutinized and examined, not only internally but by the press and tens of thousands of beta users.

Caught between the need to push the product out as soon as possible and the need to make it as stable and compatible as possible, Silverberg did a phenomenal job of picking the right trade-offs. At the end of the day, the development team was able to ship an operating system that lived up to the original vision.



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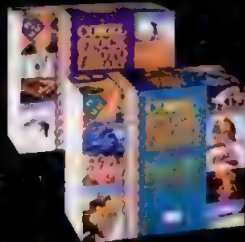
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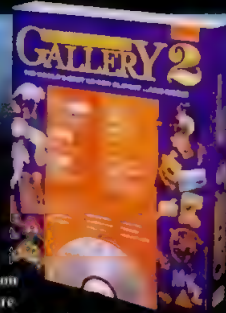
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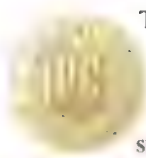
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Lifetime Achievement

Bill Gates and Paul Allen

 TWENTY YEARS AGO, A YOUNG HONEY-well engineer living in Boston was browsing through the January issue of *Popular Electronics* when he noticed a story about the MITS Altair 8800, the first well-publicized personal computer. He went to a high school friend, then attending Harvard, and suggested they port a version of the BASIC language that they had written in high school to this new machine.

The two men were Paul Allen and Bill Gates, and the rest, of course, is history. The company they created to sell that software was Microsoft, undoubtedly the most influential force in the history of personal computing.

Even when others were focusing on hardware, Gates and Allen had a vision of software as a force of crucial importance in the computer industry—and as a potentially huge business. Soon, the company was selling BASIC and other languages on many different platforms. In 1980, IBM hired Microsoft to produce PC-DOS, an OS that Microsoft resold as MS-DOS.

From there, Microsoft's successes have been legendary. It was one of the first companies to aggressively develop Macintosh software, giving it an entry into the design of products for environments with a graphical user interface. Along the way, the company broadened its line to include everything from operating systems to entertainment software.



Not everything was successful immediately, but Microsoft gained a deserved reputation as an extremely tough and aggressive company that would try and try again.

Perhaps its greatest success has been in moving the entire PC industry from the character-oriented world of DOS to the graphical world of Windows, which first shipped ten years ago. Despite limited initial success and competition from other graphical systems, Microsoft continued developing Windows. Its runaway success began with Windows 3.0 released in May 1990, and it has reached new heights in the Windows 95 juggernaut we saw this year.

Microsoft leveraged its successes into other areas as well, combining its Word, Excel, PowerPoint, and Access products into the awesomely successful Microsoft Office applications suite. It has also created a huge line of consumer titles.

Gates has headed the company throughout its life, providing both business and technical leadership. Allen left the company in 1983 but has remained on the board of directors. Since then, he has founded or been a major investor in a variety of innovative and successful computer ventures, including Asymetrix Corp., c/net: the computer network, Interval Research Corp., and Starwave Corp. With their technical leadership and vision going back 20 years, Bill Gates and Paul Allen have made an immeasurable contribution to the PC industry.

PCs

PC, COME HOME

Like television sets in the 1950s, computers are entering homes in record numbers. But unlike television, they face no curmudgeons laughing them off as a fad. For more than two years now the home market has been the fastest-growing segment of the computer industry—and for no small reason. These days, PCs are faster, easier to use, and cheaper than ever before.

Competition in this arena is stiff, to say the least. To be successful in the home market, a PC has to be usable right out of the box and include software that is useful or fun or both. In this issue, we review 32 systems designed (according to their manufacturers) specifically for the home

or home office. In addition to our standard performance testing, we looked at how user-friendly the systems are and how easy they are to set up. We also evaluated the quality and quantity of the software bundled with each system.

Some companies met and even surpassed our expectations, offering setup guides, good performance, and big, comprehensive software bundles. Others we found to be standard systems, offering no guidance to new users and very few amenities to make them appealing to any but the brave.

THE BURGEONING HOME PC MARKET

Since 1990, home PC sales have outpaced all other segments of the computer market. BIS Strategic Decisions, a market research firm, finds

By William P. Flanagan



Today's home PCs offer more than ever before—from advanced telephony features, multimedia, and MPEG support, to sleek new designs and big software bundles. PC Labs tests 32 Windows 95-equipped systems to see which ones deserve a place in your home.

that penetration of PCs into U.S. households is growing at a 13 percent compounded annual rate, from 20 percent in 1990 to a projected 36 percent in 1995.

BIS's data also affirms that home PC buyers are well educated and affluent: The average annual income of a PC-owning household is \$47,000, compared with the Bureau of the Census' most recent data, which shows that the average annual household income in the U.S. is currently about \$27,000. In fact, Packard Bell, the home PC market-share leader, says that more than one-quarter of its PCs are now sold into two-computer households.

HOME APPEAL

In many ways, home PC vendors are headed in the right direction. Acer America and Hewlett-Packard both

hired design firms to create their new home PC lines, the Aspire and the Pavilion, respectively. Acer even offers charcoal gray and emerald green cases to make systems more appealing to potential home PC buyers.

But these changes are only cosmetic. The computer industry has a long way to go to attain the penetration levels of television. And the gaps between the levels of both income and education of users and nonusers will likely be the most daunting obstacles.

As always, a major stumbling block is price, since the general consumer is notoriously cost-sensitive. Consumers can buy television sets and know that in five years they'll still be able to use them to watch their favorite shows. The same cannot be said for computers: Rapid technological advancements have been

well publicized, and the fear of spending money for something that may become outdated quickly is very real.

Education may be a more difficult obstacle. The Software Publishers Association found that in 1994, 60 percent of home PC users had attended or graduated from college, compared with 20 percent of all U.S. households. Since vendors cannot control the education level of the general population, they must find a way to increase the appeal of computers to less educated consumers by making them easier to use and less intimidating.

REVIEW CRITERIA

Things have changed a lot since our review of home PCs a year ago. Then, we recommended that you buy nothing less than a 50- or 66-MHz version of the 486 processor. To participate in last year's review vendors had to submit at least a 486-based system costing less than \$2,500 with 8MB of RAM, a 340MB hard disk or larger, a double-speed CD-ROM drive, a sound card, and speakers.

This year, we increased the specs on just about every component but let the price ceiling stand at \$2,500. We requested that vendors send us no less than PCs with a 75-MHz Pentium or equivalent processor, 16MB of RAM, a 700MB hard disk or larger, and at least a quad-speed CD-ROM drive.

Vendors also had to include a 16-bit

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sound card with speakers, and a 14.4-Kbps or faster fax modem. In addition, we told vendors to send their usual home-oriented software bundles and any other home-oriented peripherals normally included with the system, such as joysticks and microphones. Finally, we required preinstallation of Windows 95 on each PC.

With this filter as a guide, vendors sent us machines at nearly every current level of Pentium power, from 75 MHz to 120 MHz. We also received one system, from Diamond Technologies, based on the Cyrix 5x86-100 processor. A few of the systems came in at a street price of just over \$2,500 at the time of our review. Rather than

eliminating them, we took their slightly higher selling prices into consideration in judging their relative merits.

Most of the PC industry's top players are represented here. A notable exception is AST Research, which could not get us a system in time. AT&T GIS sent us a system for review, but since the unit would no longer be manufactured by the time you read this, we did not include it.

WHAT DO YOU NEED?

Given the number of systems we received in each processor category, manufacturers are looking at the 75-MHz Pentium as the entry level for the typical home PC,

HIGHLIGHTS

Home PCs

Sales of home PCs are growing at an astounding rate, currently outpacing all other segments of the computer market. And looking at the 32 systems we tested for this roundup, one can easily see why: Not only is setup for many quick, painless, and even fun, but also hardware and software features are more robust than ever before.

WE ASKED FOR MORE this year than we did for our last home PCs roundup: Our price ceiling is still \$2,500, but we upped the ante in all other respects. We asked for PCs with a 75-MHz Pentium or faster processor,

16MB of system memory, a 700MB hard disk or bigger, and at least a quad-speed CD-ROM drive.

DON'T THINK A PC has to be square and beige! New home PC case designs are bringing this information appliance just that much closer to acceptance in your living room. From Acer's designer-colored Aspire, to Hewlett-Packard's stylishly rounded Pavilion, and Packard Bell's unique "corner" PC, home machines are making their mark.

Watch out for monitors with built-in speakers, however: They do save precious desk space, but sound and

picture quality may not be up to par, especially when you turn up the volume. And DOOM is no fun if you can't hear the crunches and crashes clearly.

BIG SOFTWARE BUNDLES are a selling point for many vendors. Gateway 2000's 9-CD, 51-title Gateway Generations pack is one of the best of the lot. Microsoft's Home or Family Pack, which includes Encarta, Dangerous Creatures and Works, was one of the most popular. Beware, however, because quantity doesn't always mean quality. Check out all of your options before you buy.

The IBM PC 300

comes with a

Pentium processor,

256 KB L2 cache,

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and to the 100-MHz Pentium processor to serve the high end of the market.

With the advent of Windows 95, a Pentium-level PC is definitely the way to go. Don't be fooled by attractive prices on 486 systems. A 486DX2/66 can be found for around \$1,500 or less, but if you spend more now, your system won't become antiquated in the near future.

Our test systems were equipped with 16MB of RAM, although most home PCs are advertised with 8MB of RAM. These 8MB machines are approximately \$300 to \$400 cheaper than 16MB models, and they perform roughly on a par with a 16MB system running at the next-slower processor speed. That is, the performance of an 8MB Pentium/90 system and that of a 16MB Pentium/75 computer are roughly equivalent.

Purchasers who are less familiar with PCs may want to choose a system that offers help with setup and includes a Windows 95 tutorial and/or a custom front-end software package running on top of Windows 95 to guide them through PC functions. Acer America Corp., Compaq Computer Corp., and Packard Bell Electronics set the standard in this category, and HP's offering was also comprehensive. Each of these companies included a setup poster—sometimes called a box-topper or welcome mat—with its system, which helps to identify components and may also help with setup. And each of these systems had color-coded cables as well as a Windows front-end to make using Windows 95, and your PC, easier.

You'll have much more flexibility in your choice if you can live without this level of hand-holding. For example, some of the higher-end PCs in this roundup offer great performance but few of the amenities new users may need.

If you need high-end performance, don't go by processor speed alone. Look for a system with secondary processor cache, which will reduce the bottleneck between the processor and main memory. We found a performance decrease of about 20 percent in systems without L2 cache. Only

No Editors' Choice

For our holiday roundup of home PCs, we set out to find the perfect home system priced below \$2,500. Unfortunately, perfection will still cost you more than \$2,500. But while it's clear that we're still a few months

away from finding the perfect home PC at this price, we did find several systems that are already coming close.

What is our definition of a perfect home PC? Besides being affordable, it must have enough horsepower to satisfy your computing needs. For us, that means nothing less than a 100-MHz Pentium PC equipped with 256K of secondary processor cache and the 16MB of RAM you'll need to run Windows 95 with acceptable efficiency.

The perfect home PC must also be a total system solution, encompassing ease of setup and maintenance features, a solid warranty and support program, and software and peripherals that suit the needs of the buyer.

The system we feel comes closest to achieving our home PC ideal is the IBM Aptiva M51. But we must award an Honorable Mention to this machine rather than an Editors' Choice because, with a street price of \$2,649, it exceeds our price ceiling.



The Aptiva M51 desktop is not only easy to use, it's also powerful. Loaded with a Pentium/100 processor and 256K of L2 cache, this PC proved its mettle on our benchmark tests. For MPEG functions, the Aptiva uses a combination of software and Trident's TGUI9680 chip set.

We also liked Micron's \$2,518 P90 Home MPC. Not only was this machine a solid performer, but it boasted the best-sounding audio system in this roundup. As for market leader Packard Bell, its Pentium 100 Designer Tower does pack a lot of home PC bang, but it also was the highest priced system we tested, at \$2,849.

If you're looking for a PC that can handle home office duties, Compaq's \$2,598 Presario 9546 may fit the bill. The Presario not only can be set up as an answering machine, but its voice-recognition capabilities allow you to dial in remotely and "talk" your way through your messages.

five vendors submitted systems to this roundup with no L2 cache: Compaq, Dell, Digital, Gateway, and Packard Bell. On the whole, however, we found that the average scores that these 32 home PCs garnered on our Winstone 96 benchmark tests closely tracked those posted by machines of like CPU that we tested in our roundup of December 5, 1995.

SOFTWARE: QUALITY OR QUANTITY?

When considering a PC based on the software included, ask yourself if you want

quality or quantity. There's a big difference between getting the five titles in the Microsoft Office 95 pack and getting 30 assorted titles, few or none of which are likely to be used after a month.

All of the PCs in this roundup included some software supposedly geared toward the system's target audience. Many vendors sent Microsoft's Home or Family Pack, a group of useful and fun titles such as Encarta, Dangerous Creatures, and Works. Some other vendors sent more titles of limited quality that serve to pad the amount of software included with the system, at little or no cost to the vendor and with little or no appeal to the user.

A few units geared toward the home office included Microsoft Office 95 or Novell's Perfect Office. One of the best

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over a million geniuses
have probably told
you which portable
computer to buy.

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if any of them are right,
give us a call.



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with their two children

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There's been a
slight alteration in
the big picture.

The Crust

The Mantle

The Core

A few decades ago, new silicon formations appeared on Earth. Computers.
● They were handy for organizing information, but it was difficult to make them talk to each other. Their usefulness to business was limited. ● Enter Novell.—and global networking. ● For ten years, we've led the way in the sharing of information. Now it's clear to see: earth covers rock, information covers earth. ● And no computer is an island. ● For the whole story, check out <http://www.novell.com> on the Internet, or call us at 1 800 289-NOVL.

The Novell Network

The Atmosphere

The White Space



software bundles in the group came from Gateway, which by the vendor's count comprises 51 titles on 9 CDs.

For this roundup, we also conducted software compatibility tests to judge each PC's ability to install and run five popular CD-ROM titles successfully (DOOM II, MS Cinemania 95, MS Encarta 96, The Magic School Bus Explores the Human Body, and Myst). Although most systems performed well on these tests, a few did have some problems, which we noted in the product reviews.

MPEG AND OTHER TOYS

Many home PC vendors are also looking to multimedia-oriented features and functions to distinguish their PCs from the pack. And one of the more popular distinguishers this season is MPEG support.

MPEG is an image compression scheme for full-motion video. The MPEG image scheme takes advantage of the fact that full-motion video is made up of successive frames consisting of large, unchanged areas. And there are currently three ways to implement MPEG support: through software, the route chosen by NEC Technologies and Packard Bell; through a hardware/software combination, as in the software-assisted Trident chip set in the IBM Aptiva; or through hardware only, as in Compaq's entry.

RECENT REVIEWS

► **A Pentium for Every Desktop**
December 5, 1995.....page 102
103 machines in total: 20 Windows 3.1 machines and 83 Windows 95 machines.

► **PowerPC: A Work in Progress**
October 24, 1995page 185
3 PowerPC units compared with a 133-MHz Pentium PC.

► **Setting the Pace**
September 26, 1995.....page 183
66 133- and 120-MHz Pentium PCs.

Some systems can act as answering machines.

They offer full-duplex speakerphone capabilities and can even hook into your pager.

Another feature that distinguishes some of these PCs is telephony support. Some of these systems, such as those from Compaq and NEC, can act as answering machines; they offer full-duplex speakerphone capabilities and can even be hooked into your pager.

NEC and Packard Bell both included a remote control with their home PCs that allows you to switch between applications

or windows, or just change the song on the CD. Gateway includes a CD-changer that can hold up to three CDs, and NEC's Ready comes with an infrared port so that you can transfer files between two computers.

DO YOUR HOMEWORK

To find the system that's best suited for you and your family,

carefully evaluate your needs and skills. Think first about how prepared you are to put a system together, and how much help you're likely to need to accomplish this task.

Think about who will be using your purchase and what will they want out of it. If this is to be strictly a home-office system, check which vendors bundle the best (not the most) productivity titles. If the PC is for the whole family, see which systems have the most well-rounded software packages and offer something for the oldest as well as the youngest.

Finally, and possibly most important, check the service and support offered by each vendor. The best vendors offer three-year warranties on parts and labor, and at least one year of free on-site service. Look for companies that also have 24-hour, 7-day telephone technical support. The major vendors will also have been ranked in *PC Magazine's* latest Service and Reliability survey (July 1995) and the results will accompany each of the reviews. These will give you an idea of what *PC Magazine* subscribers think of each company's service and support (for those companies with which they've had prior experience).

So read on, do your homework, and choose wisely.

Acer America Corp.

Aspire

Acer America Corp. wants the whole family clustered around its swoopy-cased Aspire PC, surfing the Net and helping Junior with homework. The 100-MHz Pentium system (\$2,598) is attractive and offers plenty of software, but test results were mixed.

The Aspire, designed in conjunction with frogdesign, is available in charcoal or emerald mini-tower cases with rounded corners and stylishly pierced sides. It comes with a colorful setup poster and features A.C.E., Acer's custom Windows 95 front end.

The system's software includes family entertainment, reference, and educational titles, plus Microsoft Works and Quicken Special Edition.

A 14-inch monitor

SUITABILITY TO TASK	
Setup	Excellent
Edutainment	Fair
Productivity	Excellent
SERVICE & RELIABILITY	
Acer America Corp.	
Reliability	Average
Repair	Average
Technical support	Average
Percent needing repair	Average



has speakers and a microphone built in. The unit also included a 28.8-Kbps modem and a Sound Blaster 16 audio card.

The only problem in subjective video testing was some image smearing and jumpiness at full-screen size. The Aspire had good benchmark video scores, but garnered below-average scores on all Windows-based tests. In software compatibility testing, Myst hung during the install process, disabling the CD-ROM drive.

Acer offers a three-year parts, one-year labor warranty, with one year of on-site service. There is also 24-hour, 7-day toll-free technical support.—Bruce Brown
Acer America Corp., San Jose, CA; 800-733-2237, 408-432-6200; fax, 408-922-2965; web, www.acer.com.

Circle 456 on reader service card

ACMA Computers Inc.

sPower 75

A CMA Computers puts something in the box for each member of the family with its \$2,295 sPower 75. With above-average performance and a well-rounded software bundle, this 75-MHz Pen-



tium machine is targeted at the entire home market, from the home-office user to the homemaker and kids.

ACMA did not include a quick-setup guide with the mini-tower system that we tested, although one will be available by the time you read this. However, system setup was facilitated by clearly labeled ports on the rear of the machine and a sticker on the case with ACMA's toll-free technical support number. The documentation was impressive: All manuals were located in a binder and

categorized accordingly. ACMA also included a Windows 95 videotape to familiarize you with Microsoft's new operating system.

The software bundled with the system shows that ACMA was thinking about every member of the family. Productivity packages like Microsoft Works, Microsoft Money, and Microsoft Encarta, as well as fax software, will appeal to the home-office user. There is also a CD-ROM cookbook, a wine guide, and a national parks guide for the lighter side of home computing. A selection of games rounds out the package.

ACMA bundles a pair of Altec Lansing ACS5 speakers with the sPower 75; they rated *fair* on our subjective sound tests. We encountered no problems when running software compatibility tests. On our benchmark tests, the unit's Winstone 96 and Disk WinMark 96 scores were among the best of the group. Its Graphics WinMark 96 score was solidly average.

ACMA offers a one-year warranty on parts and labor that includes one year of on-site service. An additional year of on-site service costs \$99.—*William P. Flanagan*
ACMA Computers Inc., Fremont, CA; 800-786-6888, 510-623-1212; fax, 510-623-0818; e-mail, sales@acma.com.

Circle 457 on reader service card

SUITABILITY TO TASK	
Setup	Good
Edutainment	Good
Productivity	Good

All Computer Warehouse

ACW P5-120HB

A ll Computer Warehouse doesn't do much to cater to the home market with user amenities, but the \$2,198 ACW P5-120HB's terrific performance on our benchmark tests, plus its high level of software compatibility and good



SUITABILITY TO TASK	
Setup	Fair
Edutainment	Good
Productivity	Good

video playback, suggest that if you don't need any hand-holding, you can get a lot of computer for your money.

But novices take note: This PC is aimed primarily at the home user who wants to run business applications. Lacking even a quick-setup guide, the system came with nothing special to aid home users.

The software bundle, Microsoft Home Pack, includes Encarta 95 and Works, and Home CD Sampler with Entertainment

HOME PCs

How to Read the Suitability to Task and Service & Reliability Boxes

Suitability to Task

Suitability to Task ratings reflect how well a product fares for particular types of functions or operations. These ratings do not take price into account. From best to worst, possible ratings are *excellent*, *good*, *fair*, and *poor*.

Setup indicates how easy the unit was to set up and run. It considers the inclusion of quick setup guides, labeled ports and color-coded cables, customized front-ends, and easy-to-find support information

Edutainment indicates how well the unit suits educational and entertainment needs. Multimedia performance, software, and accessories are considered.

Productivity indicates how well the system suits your home or home-office productivity. Key

SUITABILITY TO TASK	
Setup	Fair
Edutainment	Good
Productivity	Excellent

SERVICE & RELIABILITY	
Company Name	
Reliability	Excellent
Repair	Average
Technical support	Better than average
Percent needing repair	Good

factors are bundled software such as office suites, communications hardware and software, and performance.

Service and Reliability

Service and Reliability ratings are included for vendors that received at least 50 responses in our latest poll of 17,000 subscribers. These results reflect readers' experience with all desktop PCs from a given vendor. For details, see our issue of July 1995.

Reliability reflects how satisfied respondents were with the reliability of the vendor's machines in use over the past two years.

Repair reflects how satisfied respondents were with the repair service the vendor provided for machines in use over the past two years.

Technical support reflects how satisfied respondents were with the vendor's technical support for machines in use over the past two years.

Percent needing repair indicates the percentage needing repair in the first year of use.



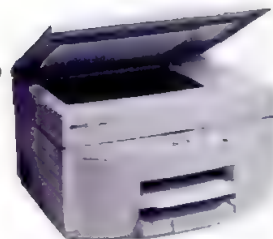
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(It does not, unfortunately, monitor taste.)



Introducing the first color printer-copier. The HP CopyJet.

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the CopyJet is easy to operate and uses plain paper. If the whole department needs color printing and copying, there's the network-ready HP CopyJet M*, for \$3199. That's just a fraction of the money you won't have to spend for color copies. Which will make you look good, no matter what you're wearing.



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Shown With The MultiSyne XV17.

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MULTISYNE® XV15™
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(13.8" viewable image size)
Max. res.: 1280 x 1024 NI at 60Hz*

MULTISYNE® XV14™
14" Non-Glare CRT
(13.0" viewable image size)
Max. res.: 1024 x 768 NI at 70Hz*

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Two 5-watt-per-channel amplified
MiniTower speakers
High-performance microphone
Fully adjustable universal speaker stand

up or down. In or out. Angle them or face them straight out. So you can customize your experience.

The MiniTower speakers deliver five watts per channel for more powerful sound than what you'll find in an

those images will stay crisp all the way out to the screen edges and corners thanks to our FullScan™ technology.

Then, add the speakers and the microphone. The NEC Multimedia Sound System's fully adjustable speaker stand lets you move the speakers

ordinary bundled system. There are separate adjustments for bass and treble. And reproduction is amazingly accurate. Plus, the speakers are designed to complement the monitors, forming an attractive, integrated package. And

the microphone enhances your voice/telephony experience.

What's more, the Sound System is compatible with Macintosh®, Compaq®, Packard Bell® and virtually every other popular PC system. In fact, the MultiSyne XV Series is one of the few monitor lines in its class offering Plug and Play compatibility for Windows® '95.

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So why just settle for the sight and sound that comes bundled with your computer? Think big. With NEC's Multimedia Sound System, the size of your experience doesn't have to be limited by the size of your desk.

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Designed for

Microsoft
Windows 95

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CIRCLE 153 ON READER SERVICE CARD

Key #28078.

Picks and Pans: Home PCs

Here are just a few of the things we liked in this year's crop of home-oriented PCs.



USA Flex. Tool time: USA Flex included some great extras with its home PC: a tool kit, surge protector, and a parallel printer cable.



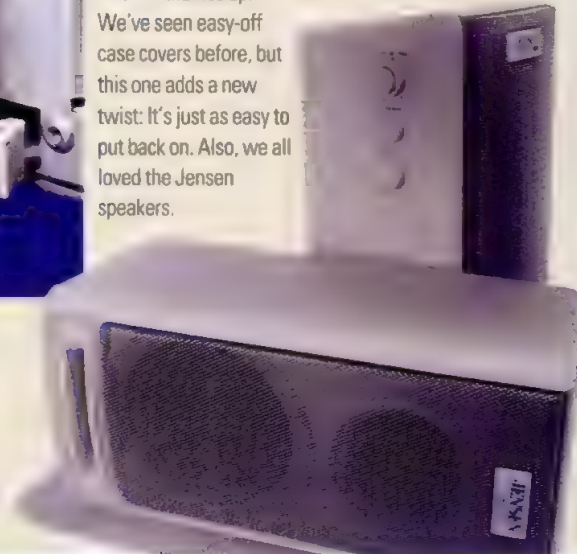
Hewlett-Packard. A colorful two-sided poster describes in detail not only how to set up your machine but also how to get around in HP's Personal Page, the vendor's Windows front end.



Packard Bell. Look Ma, no wires: Packard Bell, is taking full advantage of infrared technology by providing a remote control and infrared receptor (top right) that can run your CD-ROM drive, games, and even telephony features.



Micron. Two thumbs up. We've seen easy-off case covers before, but this one adds a new twist: It's just as easy to put back on. Also, we all loved the Jensen speakers.



Pack. A 15-inch monitor, 14.4-Kbps modem, and Microsoft Natural Keyboard are also provided.

Packed with EDO RAM, 256K of L2 cache, and a Diamond Stealth64 Video VRAM graphics board with 2MB of VRAM, the ACW P5-120HB performed well on our benchmark tests. Video playback tests showed no frame drops and a high maximum frame rate. In subjective testing, the system was fast and smooth, able to handle any full-motion video.

In software-compatibility testing, all titles loaded without modification and ran flawlessly. Unfortunately, the included MLI-691H speakers produced a hollow sound with some distortion and buzzing.

All Computer Warehouse provides a one-year warranty on parts and labor. One year of on-site service is available for \$109.95.—*Robert S. Anthony*

All Computer Warehouse, City of Industry, CA; 800-775-1953, 818-369-4181; fax, 818-961-7462.

Circle 458 on reader service card

American MultiSystems Inc.

InfoGold P90

American MultiSystems' \$2,449 InfoGold P90 offers mostly above-average performance. However, there is little else about the unit that will appeal to its target market of home-office users. The system's software bundle appears more appropriate for family users.

Setup was not facilitated at all. There was no setup guide, and none of the unit's ports were labeled. Bundled software included Microsoft's Encarta 95, Golf, and Works, but none of these packages were preinstalled on the unit. Installation is not a big problem for someone with some PC experience, but the novice may find the process slightly daunting.

The system's speakers were integrated on the monitor, but the display shimmered when we ran an audio CD with a heavy bass effect. The unit had no problems running any of the applications in our software-compatibility tests.

The InfoGold P90 excelled on our benchmark tests. On the Winstone 96 tests, it turned in the best score in its

Pentium/90 group; its score even rivaled those of some other machines with speedier CPUs. On our Disk WinMark 96 and Graphics WinMark 96 tests, it also posted above-average scores for its class.

SUITABILITY TO TASK	
Setup	Fair
Edutainment	Good
Productivity	Good

American Multi-



Systems offers a one-year parts-and-labor warranty on the InfoGold P90. However, on-site service will cost you an additional \$75 for one year.—WPF

American MultiSystems Inc., Milpitas, CA; 800-888-6615, 408-945-2296; fax, 408-945-2299; e-mail, infogold2@aol.com.

Circle 459 on reader service card

Compaq Computer Corp.

Presario 9546

Compaq Computer Corp.'s high-end home PC, the \$2,598 Pentium/100-based Presario 9546, is designed for work-at-home users who want the expandability of a mini-tower. The Presario family also includes the 5500 series of all-in-one PCs and the entry-level 7100 series.

The Presario has a helpful setup guide and color-coded cables. Presario Gallery, its Windows front end, makes it easy to get around your applications. It comes with Microsoft Works, Quicken, and a good selection of home reference titles.

Conventional DRAM and no L2 cache held down the Presario's Winstone 96 score, but the unit scored well on our video tests. In subjective testing, only full-screen video clips dropped frames noticeably. Two problems arose in our software compatibility testing: DOOM had to be run with no sound in the default setup; Myst hung during installation and disabled the CD-ROM.

The Presario is MPEG-ready, and its wavetable audio chip supports Compaq's TrueQ Spatializer 3-D sound. In audio tests the speakers were great in middle

and high ranges but rumbled in the bass.

A full-duplex speaker phone works with the 19.2/14.4-Kbps data/fax modem. With the voicemail software, you can dial in and "talk" your way through your messages.—BB

Compaq Computer Corp., Houston, TX; 800-345-1518; fax, 713-518-1442; Web, www.compaq.com.

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SUITABILITY TO TASK	
Setup	Excellent
Edutainment	Good
Productivity	??????

SERVICE & RELIABILITY

Compaq Computer Corp.

Reliability	Better than average
Repair	Better than average
Technical support	Better than average
Percent needing service	Better than average



Apple Performas: Ready for the Big Leagues?

By Mary E. Behr

Apple Computer Corp. has long been a major player in the home computer market. But times are changing: Apple's U.S. market share of desktop PC shipments has been steadily declining over the past few years, and is projected to dip once again, from 12 percent in 1994 to an estimated 10 percent in 1995, according to market researcher Computer Intelligence/InfoCorp. Compaq and Packard Bell, nipping at Apple's heels in the past, have now taken the lead.

Apple is hoping that the Mac Performa 5200/6200 series will reverse this trend. One member of this family, the Performa 5215 CD, is targeted at the first-time user as an all-in-one-box solution. It is the only unibox system in the Performa line; prices range from \$1,899 to \$2,199. The Performa 5215 CD that we looked at was powered by

a 75-MHz Power PC 603 processor with 8MB of RAM.

Setting up the Performa was easy. The first thing you see is a big setup poster, and then the Accessory Kit box with the words "Look Inside" printed on it in big type; it includes the Apple Macintosh CD and manuals. All ports and cords are labeled with icons; you simply match them up, and plug in. Unlike a PC, this system has only two items to attach—the keyboard to the unit and the mouse to the keyboard. Then plug the unit into a wall socket, and you're ready to roll.

The Performa, being an all-in-one unit, features built-in speakers, although they are somewhat small and tinny-sounding. Volume and brightness controls are also built into the front of the Performa's case, as is a double-speed CD-ROM drive, and 3.5-inch floppy disk drive.

Internet and World Wide Web access is provided through eWorld, Apple's on-line service. The Performa comes with 25 software titles (which includes 8 CD titles) preloaded, including Quicken 4, ClarisWorks 2.1, and the New Grolier Multimedia Encyclopedia.

There are three other configurations in the Performa family: the 630 Series, built around a 66/33-MHz Motorola processor, 8MB of RAM and 250MB minimum hard disk, with prices ranging from \$1,299 to \$1,449; the 6100 Series, which starts at \$1,699, and features a 60-MHz Power PC 601 processor, 8MB of RAM and 200MB minimum hard disk; and the 6200 Series, based on a 75-MHz PowerPC 603 CPU, 8MB or 16MB of RAM, and a 1GB hard disk, starts at \$1,999. All configurations include CD-ROM drives and fax modems.

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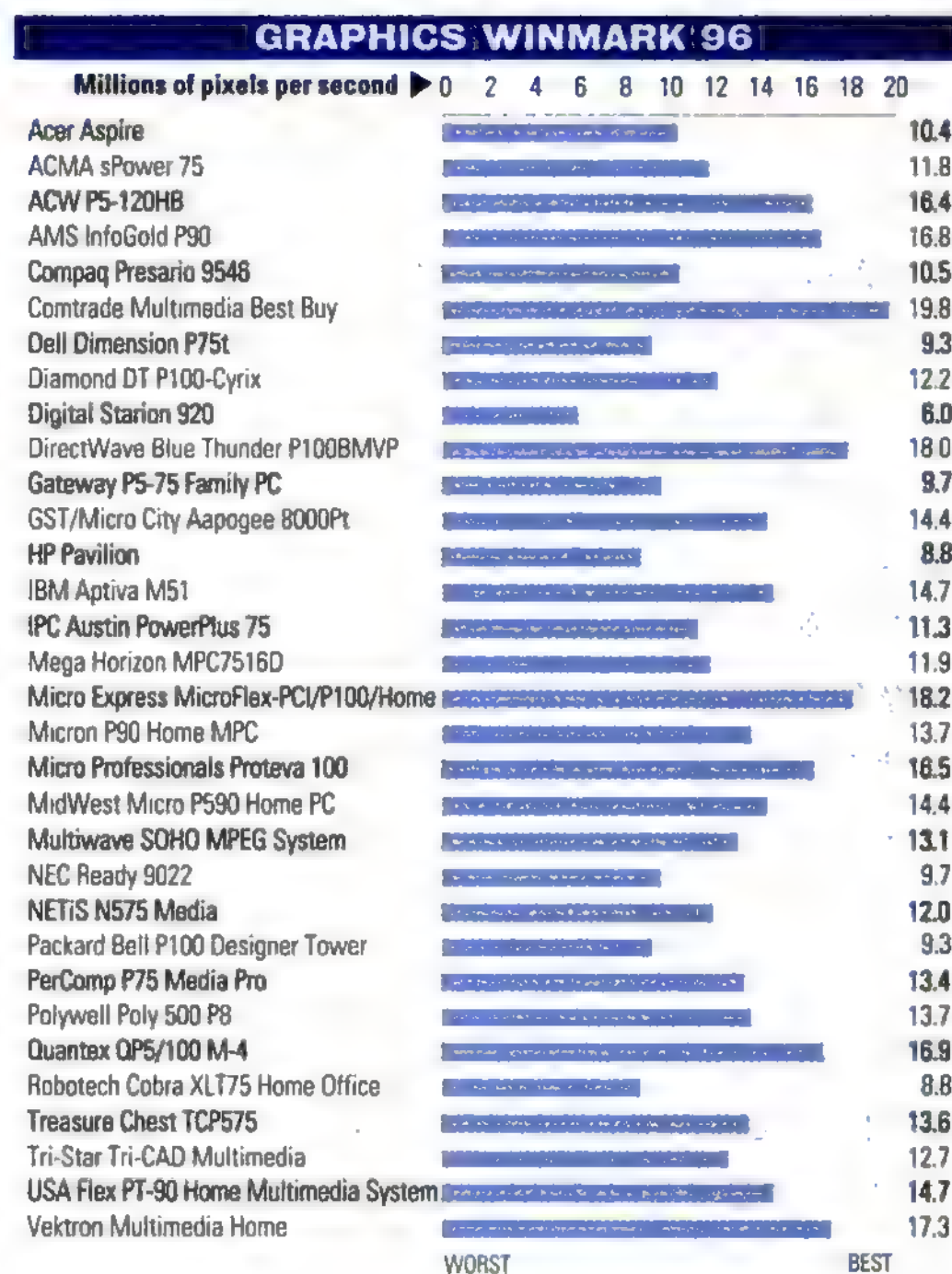
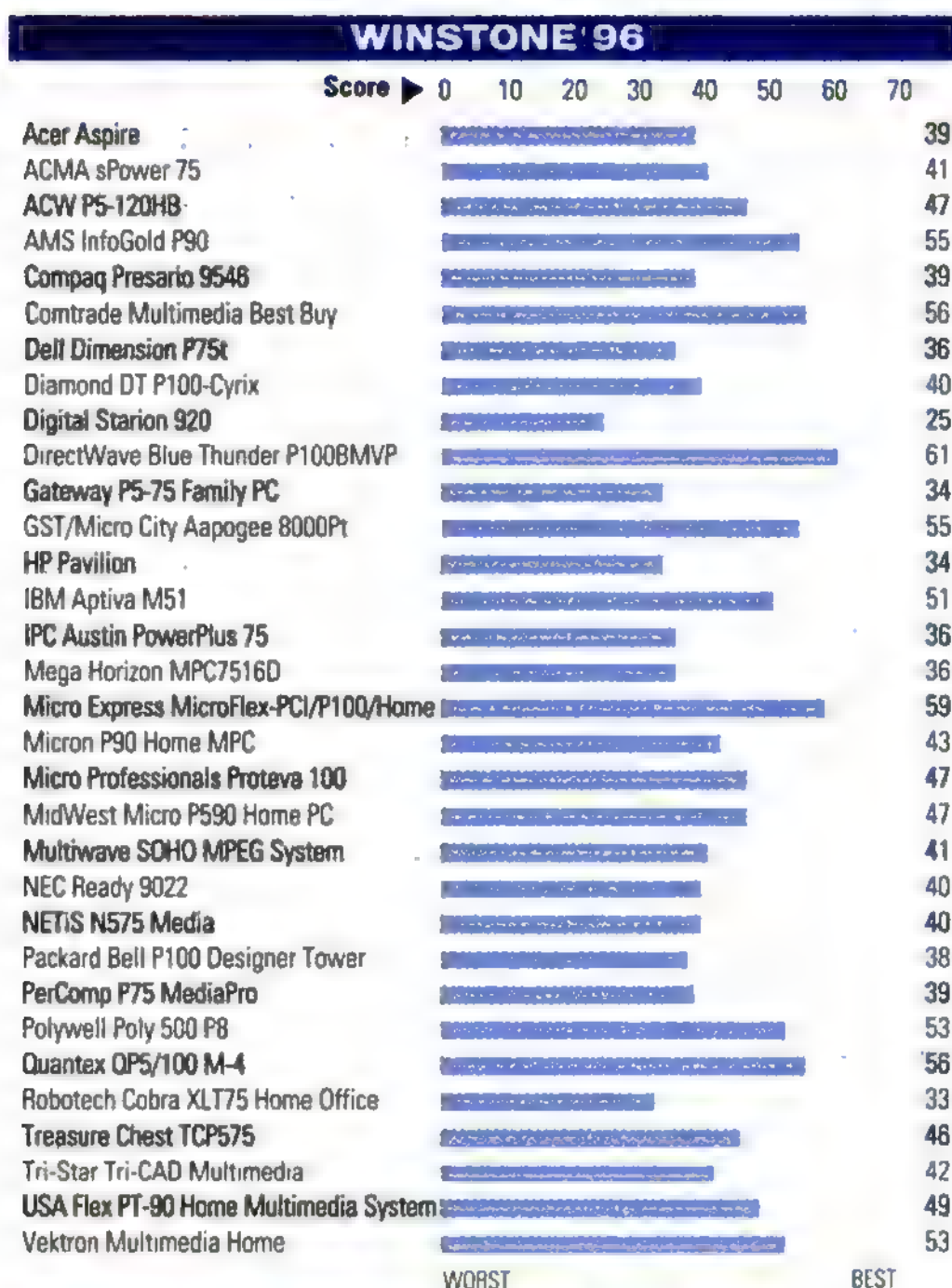
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Benchmark Tests: Home PCs

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What the Numbers Mean

Although no vendor was able to send a machine with a 133-MHz Pentium and still meet our price filter, 13 systems did have Pentium/100 CPUs, while the majority of the remaining units used Pentium/75s. We also saw four Pentium/90-equipped PCs, and two Pentium/120s. The 3.3-volt Cyrix 5x86-100—positioned by Cyrix to compete with low-end Pentiums—also makes an appearance in this roundup.

WINSTONE 96

Top Winstone scores don't necessarily have to go to systems with the fastest CPUs. The top three Winstone performers—DirectWave's Blue Thunder P100BMVP, Micro Express's MicroFlex-PCI/P100/Home, and Quantex Microsystems' QP5/100 M-4—all had Pentium/100 CPUs. What these machines have in common is use of 256K of pipelined-burst cache and Intel Triton chip sets. As we found previously, this combination helps to produce top Winstone scores.

Lack of L2 cache and the use of a 32-bit graphics chip set put Digital's Starion 920 in last place on our Winstone tests.

GRAPHICS WINMARK 96

The Comtrade Multimedia Best Buy produced the highest Graphics WinMark 96 score, aided by a Diamond Stealth64 Video VRAM graphics accelerator card, which utilizes S3's Vision968 chip set and 2MB of 70-ns VRAM. The Vision-968 has a 64-bit data path, powerful graphics acceleration, and integrated video scaling and acceleration.

Machines using S3's Trio32 graphics engine produced low scores because this chip's 32-bit data path simply cannot keep up with today's 64-bit designs. The lowest-scoring units on this test all had DRAM instead of the faster, dual-ported VRAM, and all used integrated graphics chips attached to the PCI bus instead of PCI graphics add-in cards.

DISK WINMARK 96

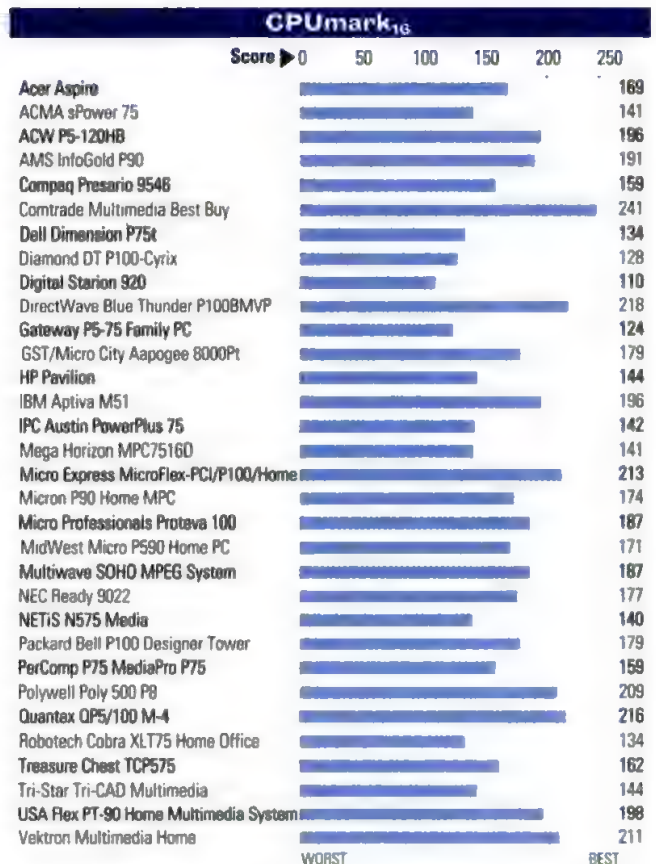
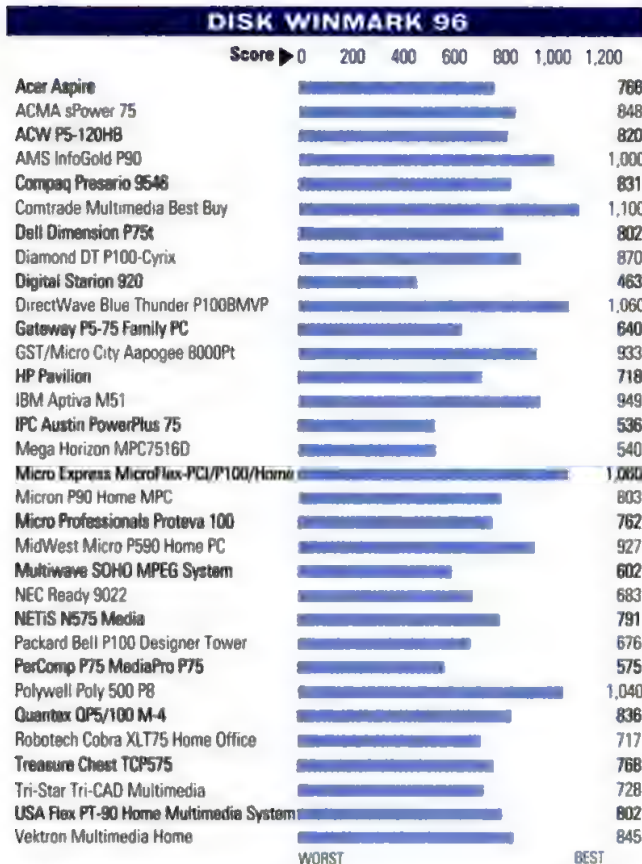
The top ten machines on our Disk WinMark measure—and most of the top Winstone performers as well—all used Quantum's Fireball 1080A hard disk. The Comtrade Multimedia Best Buy took first place on this measure.

Conversely, any machine using Conner's CFS 1275A or CFS 850A hard disks (both have 3,600-rpm rotational



Benchmark Tests: Home PCs

CONTINUES



speeds and 22-ms access times) garnered poor Disk WinMark scores. These budget drives get the job done but cannot keep up with faster drives that have 4,500-rpm or 5,400-rpm rotational speeds.

Unfortunately for the Digital Starion 920, its lack of L2 cache and its use of the Conner CFS 1275A hard disk resulted in the lowest Disk WinMark score of this roundup.

CPUMARK₁₆ AND CPUMARK₃₂

It's not surprising that the Comtrade Multimedia Best Buy earned the highest CPUmark scores: It was one of only two PCs with a 120-MHz CPU. The Multimedia Best Buy also uses Intel's Triton chip set and 256K of L2 cache.

Equipped with pipelined-burst L2 cache and Triton chip sets, the Pentium/100-based systems from DirectWave, Micro Express, and Quantax earned scores that are comparable to those of Pentium 120 systems. Digital's Pentium/75-equipped Starion 920 posted the lowest CPUmark₁₆ and CPUmark₃₂ scores; lack of L2 cache was the main culprit.

Diamond Technologies' DT P100-Cyrix machine used the new Cyrix 5x86-100 CPU. This processor contains a 16K

write-back L1 cache and has a single pipeline, which allows for a reduced die size but causes a performance penalty:

The Diamond system's CPUmark scores were 10 percent lower than the average of the Pentium/75 machines in this review. There is a further trade-off: To support the Cyrix 5x86-100's 486 pinout structure, older chip sets must be used. Though using these older chip sets saves money, it precludes support for newer, faster components such as pipelined-burst cache and EDO DRAM.

CD-ROM AND MULTIMEDIA TESTS

The CD-ROM WinMark 96 test taxes different aspects of the CD-ROM subsystem. The Matsushita CR-574-B, a quad-speed CD-ROM drive found in the Packard Bell, Polywell, and Robotech systems, helped these units achieve the highest scores on this test in their respective classes.

Our CD-ROM Sequential 16K Read test uses 16K block-size sequential reads from the CD-ROM; test results should mirror the CD-ROM drive's transfer rate. All drives performed at or near their rated speeds. On the CD-ROM Access Time test, units using the Toshiba XM-5302B CD-

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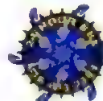
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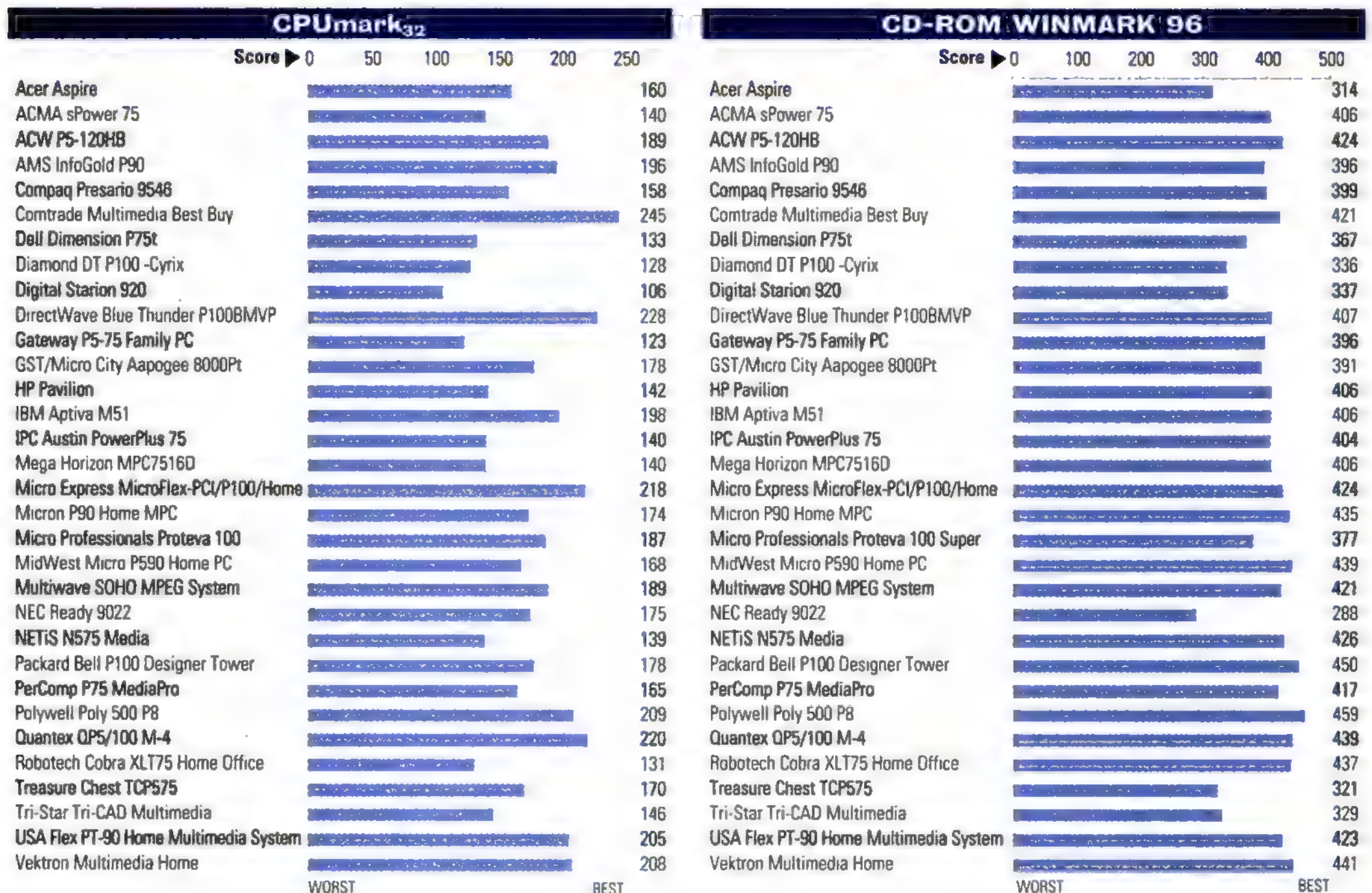
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CIRCLE 235 ON READER SERVICE CARD



Benchmark Tests: Home PCs

CONTINUES



ROM drive consistently produced the best (lowest) scores, although most scores were closely spaced.

Our CPU Utilization test measures how much of the CPU's resources are used for servicing the CD-ROM drive; note that scores can be compared only across systems with the same CPU and the same-speed CD-ROM drive (lower scores represent better performance). Units containing a Mitsumi CD-ROM had low CPU Utilization scores.

On our Action Indeo and Full-Screen Scaling tests, the graphics subsystem is not the only important factor. The CPU, CD-ROM, and sound subsystem all have their roles. Faster CPUs and CD-ROMs can reduce CPU utilization and help lower the number of video frames dropped; 64-bit graphic chip sets with built-in video acceleration also minimize dropped frames and improve temporal quality.

—Analysis written by Margaret A. Piemonte

How We Tested

We tested all machines with 700MB or larger hard disks, quad-speed or faster CD-ROM drives, 16-bit sound boards, and 16MB of RAM. We used each vendor's preinstalled graphics driver for 1,024-by-768 resolution with

256 colors, small fonts, and a refresh rate of 75 Hz. We also disabled power-management features and let Windows 95 manage virtual memory settings.

We used our benchmark test suite **Winstone 96, Version 1.0**, to measure the units' performance when running typical Windows applications. Winstone 96 measures the time a PC takes to execute a set of scripts that exercise 13 of the best-selling Windows 3.1 applications. It derives a composite number and then converts it to a score relative to the performance of a 486SX/25 Dell 425s/P with 8MB of RAM, whose score is defined as 10.

We used our benchmark test suite **WinBench 96, Version 1.0**, as a measure of graphics, disk, processor, CD-ROM, and motion-video performance under Windows. The **Graphics WinMark 96** score, based on 115 tests of Windows GDI functions, represents the performance of each machine's graphics subsystem under Windows. The **Disk WinMark 96** score represents the disk subsystem's performance under Windows. The **CPUmark₁₆** and **CPUmark₃₂** scores indicate the speed of a computer's processor subsystem when performing 16- and 32-bit operations under Windows. These CPU scores are based on large instruction mixes that emulate the CPU activity of real-world applications.

The **CD-ROM WinMark 96** score gauges the performance of the machine's CD-ROM subsystem, which includes the CD-ROM drive, the adapter to which it is connected, and the software drivers it requires to operate. This



Benchmark Tests: Home PCs

ENDS

	WINSTONE 96				CD-ROM			HIGH-QUALITY ACTION INDEO ¹		FULL-SCREEN SCALING ²		MEDIUM-QUALITY ACTION CINEPAK ³	
	Spread-sheet	Word Processing	Database	Business Graphics/DTP	Sequential 16K Read	Access Time (ms)	CPU Utilization	Frames Dropped	CPU Utilization	Frames Dropped	CPU Utilization	Frames Dropped	CPU Utilization
	▲	▲	▲	▲	▲	▼	▼	▼	▼	▼	▼	▼	▼
Acer Aspire	3.4	4.1	4.0	4.3	612 KBps	339	37%	402	99%	0	92%	0	61%
ACMA sPower 75	3.8	4.2	4.3	4.3	613 KBps	198	68%	114	99%	0	98%	0	68%
ACW P5-120HB	4.3	4.9	4.9	5.0	611 KBps	195	66%	0	97%	0	92%	0	67%
AMS InfoGold P90	5.1	5.7	6.0	5.5	612 KBps	207	66%	0	95%	0	87%	0	62%
Compaq Presario 9546	3.4	4.2	4.2	4.2	612 KBps	223	44%	373	99%	31	99%	0	75%
Comtrade Multimedia Best Buy	5.0	5.7	5.9	5.8	611 KBps	231	56%	0	77%	0	77%	0	49%
Dell Dimension P75t	3.3	3.7	3.8	3.9	612 KBps	334	39%	0	97%	0	81%	0	54%
Diamond DT P100-Cyrix	3.6	4.0	4.4	4.0	612 KBps	395	49%	345	99%	286	99%	0	56%
Digital Starion 920	2.3	2.7	2.5	2.5	614 KBps	293	45%	448	92%	293	99%	0	80%
DirectWave Blue Thunder	5.6	6.3	6.6	6.0	614 KBps	242	37%	0	77%	0	67%	0	44%
Gateway P5-75 Family PC	3.1	3.5	3.4	3.6	614 KBps	250	60%	158	99%	22	96%	0	70%
GST/Micro City Apogee	5.1	5.7	5.7	5.5	612 KBps	203	64%	0	91%	0	88%	0	64%
HP Pavilion	3.0	3.6	3.5	3.8	611 KBps	245	34%	190	99%	1	83%	0	53%
IBM Aptiva M51	4.5	5.3	5.5	5.2	611 KBps	231	34%	0	99%	0	72%	0	47%
IPC Austin PowerPlus 75	3.4	3.8	3.5	3.8	613 KBps	191	69%	246	99%	0	97%	0	69%
Mega Horizon MPC7516D	3.4	3.7	3.6	3.7	611 KBps	190	70%	145	99%	44	99%	0	70%
Micro Express MicroFlex	5.4	6.1	6.2	5.8	612 KBps	197	63%	0	88%	0	82%	0	60%
Micron P90 Home MPC	3.9	4.6	4.3	4.5	613 KBps	222	45%	0	98%	0	84%	0	59%
Micro Professionals Proteva	4.0	4.9	5.0	4.7	681 KBps	237	59%	0	86%	0	85%	0	52%
MidWest Micro P590 Home PC	4.3	4.7	4.9	4.7	681 KBps	230	52%	0	90%	5	81%	0	53%
Multiwave SOHO MPEG	3.7	4.4	4.0	4.3	680 KBps	246	53%	128	99%	0	85%	0	58%
NEC Ready 9022	3.4	4.2	4.3	4.2	611 KBps	389	42%	399	99%	0	97%	0	66%
NETIS N575 Media	3.7	4.2	4.2	4.1	676 KBps	227	63%	79	99%	0	94%	0	60%
Packard Bell P100 Designer Tower	3.4	4.0	4.0	4.2	612 KBps	238	36%	312	99%	0	81%	0	52%
PerComp P75 MediaPro	3.7	4.2	3.9	4.0	612 KBps	203	68%	83	99%	0	94%	0	65%
Polywell Poly 500 P8	4.9	5.4	5.7	5.6	614 KBps	239	35%	206	99%	0	74%	0	46%
Quantex QP5/100 M-4	5.2	5.9	5.7	5.6	612 KBps	185	60%	0	86%	0	82%	0	58%
Robotech Cobra XLT75	2.9	3.5	3.6	3.5	613 KBps	236	62%	441	98%	378	99%	0	82%
Treasure Chest TCP575	4.3	4.7	4.7	4.7	611 KBps	322	40%	0	95%	0	76%	0	48%
Tri-Star Tri-CAD Multimedia	3.9	4.2	4.3	4.2	613 KBps	395	50%	31	99%	0	88%	0	55%
USA Flex PT-90 Home	4.7	5.0	4.9	4.8	610 KBps	195	64%	191	99%	33	99%	0	71%
Vektron Multimedia Home	5.1	5.6	5.3	5.4	914 KBps	253	64%	0	82%	0	70%	0	46%

1 With an Action, Indeo, 320 x 240, 30-fps, 600-KBps clip. 2 With an Action, Indeo, 160 x 120, 30-fps, 300-KBps clip scaled to full screen (1,024 x 768). 3 With an Action, Cinepak, 320 x 240, 30-fps, 300-KBps clip.

number is based on a profile of six of today's most popular Windows-based CD-ROM applications in three market categories.

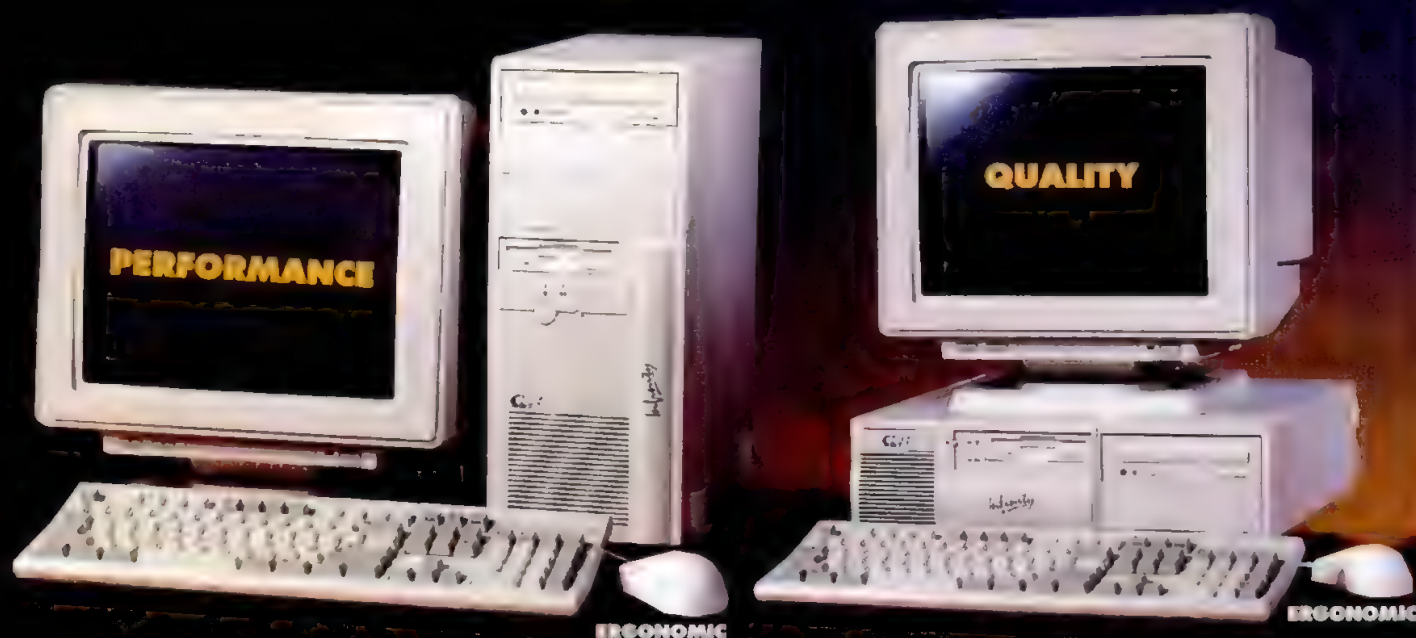
The **CD-ROM Sequential 16K Read** test measures the throughput of the CD-ROM subsystem when reading 16K blocks of data on a CD-ROM. The **Access Time** score reflects the CD-ROM drive's performance while randomly accessing 2K blocks from the entire CD-ROM.

We also use the **CD-ROM CPU Utilization** score to represent the percentage of the processor's bandwidth occupied by servicing the CD-ROM subsystem while it retrieves data. To determine the utilization, WinBench 96 uses a default block size of 16K. The transfer rate defaults to the maximum transfer rate of a particular CD-ROM subsystem. WinBench 96 calculates this transfer rate before it runs the actual test.

WinBench 96 also includes video tests, which measure a PC's ability to play full-motion AVI video files. This test suite allows us to test video playback performance with two types of clips at a variety of data and frame rates, using

either the Indeo or Cinepak codec. We report results from the **High-Quality Action Indeo** tests, which use the Action, Indeo, 320 by 240, 30 frame-per-second, 600-kilobyte-per-second video clip; the **Full-Screen Scaling** tests, which use the Action, Indeo, 160 by 120, 30-fps, 300-KBps video clip; and the **Medium-Quality Action Cinepak** tests, which use the Action, Cinepak 320 by 240, 30-fps, 300-KBps video clip. We report both the number of frames dropped while playing each video clip and the CPU utilization, which measures the percentage of CPU resources used to run each video clip.

We also performed **Software Compatibility** tests and informal sound tests. We installed five popular CDs on each of the reviewed systems, rating the ease of installation, how well the programs ran, and gauging the quality of video and sound. To get a feel for the overall sound quality, a panel of *PC Magazine* staffers listened to MS Windows .WAV files and Red Book audio CDs (regular music CDs) played by each system. Sound clips were chosen to express both high tones and bass tones, as well as mid-range tones.



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- Tool-free Midtower Case
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CIRCLE 387 ON READER SERVICE CARD



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Price/Performance Index: Home PCs

Acer, Compaq, and IBM were all on top in terms of class-leading "bang" scores. However, all three exceeded our price ceiling of \$2,500. The \$2,598 Compaq Presario 9546 is MPEG-ready, featuring a wavetable audio chip that supports Compaq's TrueQ Spatializer 3D sound. The \$2,649 IBM Aptiva M51 offers everything you could want in a home PC: easy setup, strong performance scores, quality software, and top-notch hardware. The stunning \$2,598 Acer Aspire, designed in conjunction with frogdesign, will undoubtedly look great next to the stereo: It's available in charcoal or emerald cases with rounded corners and stylishly pierced sides.

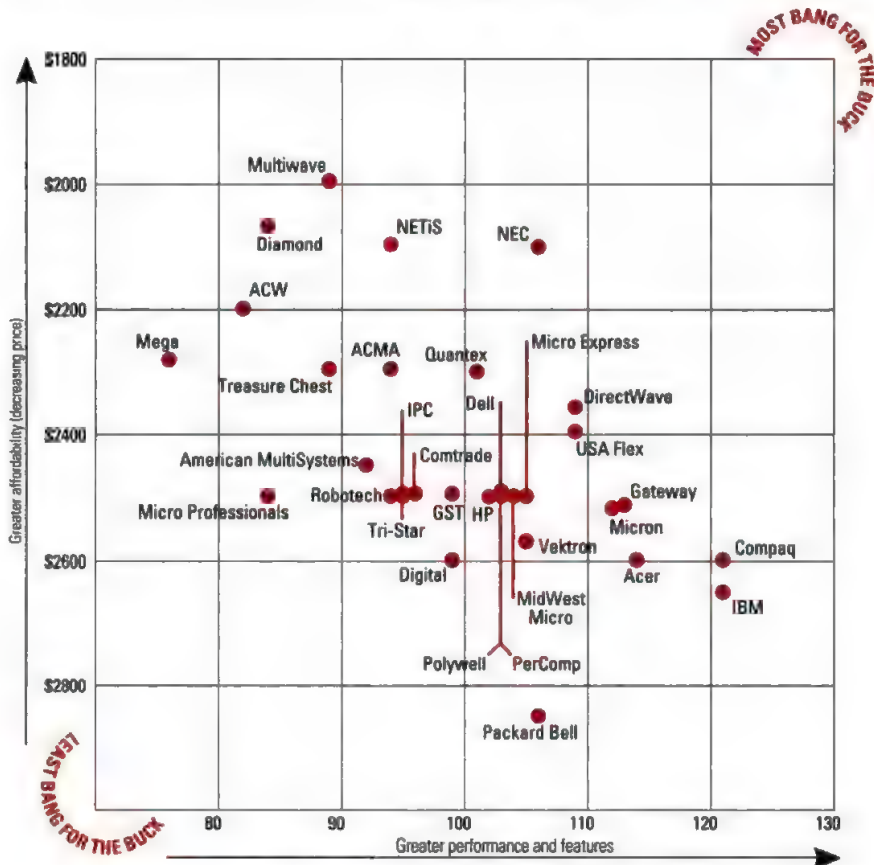
One machine, Hewlett-Packard's \$2,500 HP Pavilion, met our filter price and produced a respectable performance/features score. The \$2,500 HP Pavilion comes in a mini-tower case, designed by Luna Design, that bulges in front and has a crease for the power button and status lights. Setup is easy, helped by a colorful poster and color-coded cables.—*Analysis written by Mary E. Behr*

THE DATA POINTS

The features that make a good home PC are very different from those that make a good business machine, and the performance and features ratings reflect this unusual criteria. Performance usu-

ally accounts for almost half of the bang score; in this story we weigh only four tests (Winstone 96, CD-ROM WinMark 96, software compatibility, and audio ratings), and together they make up 35 percent of the score. Home PC-specific features like color-coded cables,

setup posters, easily located technical support numbers, tool-free chassis, and modem features make up almost 20 percent of the score. The rest of the score is made up of features like hard disk size and various warranty and support options offered by the vendors.



Comtrade

Comtrade Multimedia Best Buy

Comtrade positions the \$2,495 Comtrade Multimedia Best Buy as a total family/home-office solution. It may be better suited to the power home-office user, however, as the company offers little guidance for the new user and the software bundle is not particularly home-centric. If you can't resist having a 120-MHz Pentium system sitting in your office or den, and you know your way around a PC, this could be the machine for you.

This mini-tower system was well packaged and neatly organized. A setup book-

let was included and all ports were labeled, but nothing else was included to facilitate setup. The unit's software bundle consisted of Microsoft's Encarta and Works, plus a few entertainment-oriented titles.

Comtrade does deliver performance. The Multimedia Best Buy was the better of the two 120-MHz Pentiums in this roundup. Still, there were a few 100-MHz Pentiums that turned in an equal or a better score on our Winstone 96 tests.

The unit's Midi Land MLI-95 speakers were rated fair by our sound jury. In software-compatibility testing, the ma-

chine had no problem installing and running any of our four test applications.

The Comtrade Multimedia Best Buy is backed by a one-year

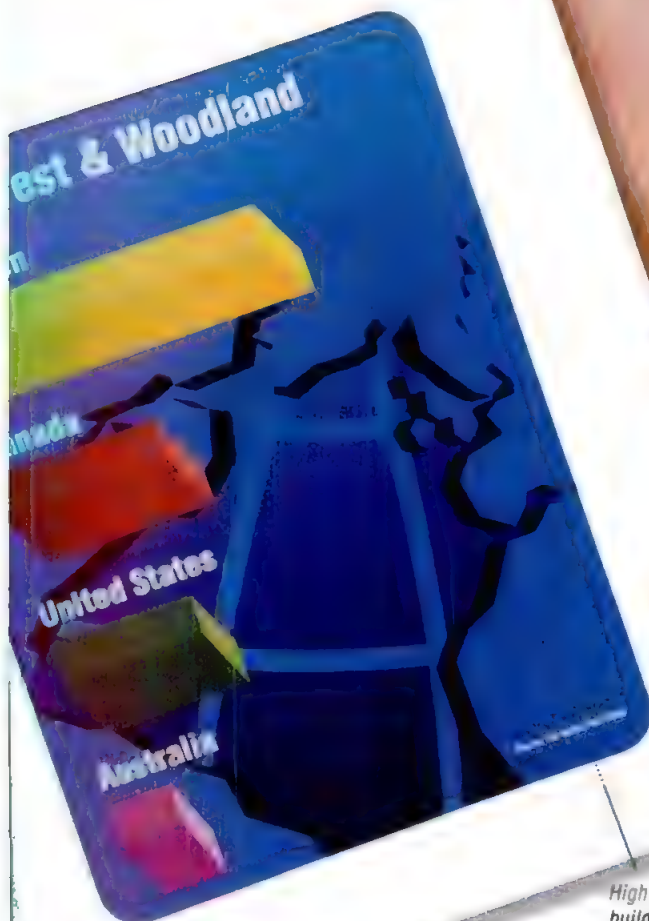
SUITABILITY TO TASK

Setup	Fair
Edutainment	Good
Productivity	Good

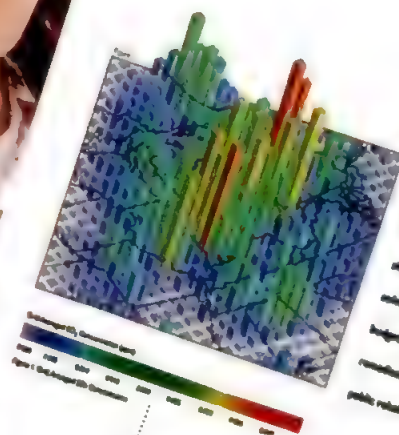


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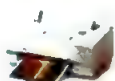
With the combustion of gas, petroleum
products (SO₂) is released into the atmosphere.
The results from concentrations of sulfur dioxide
from 0.01 to several parts per million, SO₂ can
lead to the decay of buildings and monuments, solid
human disabilities.

Samples of SO₂ for this report were collected between
August and October, 1995. Using GPS, an off-shore
platform, state-of-the-art environmental and visualization
software package, the assessment team were able
to budget, while providing comprehensive analysis
for remediation planning, regulatory reporting, and public
relations.

The summary view representing SO₂ concentration
in the United States offers a clear, concise graphical
representation on which corporate environmental
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Comtrade, City of Industry, CA; 800-969-2123, 818-961-6688, fax, 818-369-1479.

Circle 461 on reader service card

Dell Computer Corp.

Dimension P75t

If you're looking for a solid home productivity machine, Dell may have your dream PC. The \$2,491 Dimension P75t features a 75-MHz Pentium processor as well as Microsoft Office Professional for Windows 95, Quicken, and a U.S. Robotics Sportster 28.8-Kbps modem.

Dell gets a high rating for good packaging and informative setup materials

SUITABILITY TO TASK	
Setup	Good
Edutainment	Fair
Productivity	Good

SERVICE & RELIABILITY

Dell Computer Corp.

Reliability	Better than average
Repair	Better than average
Technical support	Better than average
Percent needing repair	Average

(always a strong point in the Dell machines).

The Dimension P75t came without L2 cache; however, it garnered an above-average Disk WinMark 96 score. The unit's Graphics WinMark 96 score was



below average, and its Winstone 96 score was average.

On our video-clip speed tests, the unit had above-average frame rates in all clip sizes. In subjective video-clip testing, full-motion video was smooth, with only minimal frame dropping in full-screen size.

The Dimension P75t sounds good, too, thanks to a Sound Blaster 16 audio card and a set of Altec Lansing ACS5 speakers (though bass response was off a bit). There were no software compatibility problems.

Dell's warranty covers parts for three

years and labor and on-site service for one year. Toll-free technical support is available 24 hours, 7 days.—BB

Dell Computer Corp. Austin, TX; 800-289-1460, 512-338-4400; fax, 800-727-8320; web, www.us.dell.com.

Circle 462 on reader service card

Diamond Technologies Inc.

DT P100-Cyrix

The DT P100-Cyrix, from Diamond Technologies, is aimed at family and home-office users, and, with a street price of \$2,065, is one of the least expensive systems in this review. Although little guidance for new users is provided, this PC performed adequately in most areas of testing.

After the system is set up (with no assistance from Diamond, as no setup guide of any form is provided), users find themselves with a software bundle that includes variations of many popular titles such as Discis Presents... National Geographic Society Dinosaurs and Kids Can Read. The list also includes Grolier's Encyclopedia and Business Library.

Diamond's PS-201S speaker system was rated fair on our subjective sound

tests; the PC itself had no problems on our software compatibility tests.

On our benchmark tests, this system (based on a Cyrix 5x86-100 CPU) com-



SUITABILITY TO TASK

Setup	Fair
Edutainment	Good
Productivity	Good

pared favorably to the other Pentium/75 entries, posting above-average Disk WinMark and Graphics WinMark scores.

Diamond Technologies backs the system with a one-year parts-and-labor warranty that includes on-site service.—WPF

Diamond Technologies Inc., Anaheim, CA; 800-989-7253, 714-533-9910; fax, 714-533-7805; Web, www.diamondtech.com.

Circle 463 on reader service card

SUMMARY OF FEATURES

Home PCs

Price For PCs sold through resellers, assume street prices will be 15 to 20 percent lower than list. Some companies factor this discount into their quoted prices; in such cases, we indicate that the cited price is a street price.

Installed RAM Some PCs use EDO (extended data out) DRAM, which may boost performance over standard fast-page mode DRAM.

Hard disk interface EIDE denotes Enhanced IDE, an extension to IDE that supports faster transfer rates, higher disk capacities, and other mass-storage devices. Fast ATA-2 denotes Seagate's specification for increased transfer rates and larger capacities.

Monitor claimed display size/actual viewing area The claimed display size is the vendor's claimed size of the monitor. The actual viewing area is the diagonal measurement of the screen. In many cases the claimed size is

larger than the actual viewing area.

CD-ROM drive interface ATAPI is a specification that enables CD-ROM drives to act much like hard disks, which allows them to be connected to Enhanced IDE interfaces.

Expansion-bus slots PCI cards may share a backplate with ISA cards, meaning that you cannot use both simultaneously. These shared slots are listed as PCI/ISA.

Integrated software refers to a software package that includes word processing, spreadsheet, and database programs all in one, such as Microsoft Works. Software suites, like Novell Perfect Office, are also included.

A Windows front end is a preinstalled program that the manufacturer has provided to make the user familiar with the PC and its features.

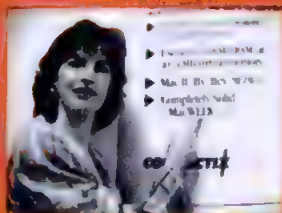
What Can You Do With A \$100 Digital Video Camera?

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System Requirements: A PC equipped with a 386, 486, Pentium or equivalent processor • Windows 3.1 or 3.11 • Windows for Workgroups 3.1 or 3.11 • 4 MB RAM required.



MAKE MOVIES



VIDEO CONFERENCE



TAKE PICTURES



BE CREATIVE

SUMMARY OF FEATURES

Home PCs

■ YES □ NO

In alphabetical order by company

	Acer Aspire	ACMA sPower 75	All Computer Warehouse ACW P5-120HB	AMS InfoGold P90	Compaq Presario 9546	Comtrade Multimedia Best Buy	Dell Dimension P75t	Diamond DT P100-Cyril
Price of tested configuration	\$2,598 (street)	\$2,295 (street)	\$2,198 (street)	\$2,449 (street)	\$2,598 (street)	\$2,495 (street)	\$2,491 (street)	\$2,065 (street)
Case type	Mini-tower	Mini-tower	Tower	Desktop	Mini-tower	Mini-tower	Mini-tower	Desktop
Processor	Pentium/100	Pentium/75	Pentium/120	Pentium/90	Pentium/100	Pentium/120	Pentium/75	Cyrix/100
Installed RAM	16MB	16MB	16MB EDO	16MB	16MB	16MB EDO	16MB EDO	16MB
Hard disk capacity and interface	1.2GB EIDE	1GB Fast ATA-2	1GB Fast ATA-2	1GB Fast ATA-2	1GB Fast ATA-2	1GB Fast ATA-2	1GB Fast ATA-2	1GB Fast ATA-2
Graphics adapter	Integrated (Cirrus Logic GD5440J chip set)	Diamond Stealth64 DRAM	Diamond Stealth64 Video VRAM	Diamond Stealth64 DRAM	Integrated (S3 Trio64VT chip set)	Diamond Stealth64 Video VRAM	Integrated (S3 Trio64VT chip set)	Diamond Stealth64 DRAM
Memory	1MB DRAM	2MB DRAM	2MB VRAM	2MB DRAM	1MB EDO DRAM	2MB VRAM	1MB DRAM	2MB DRAM
Monitor	Acer Aspire 33s	Amax Impression5	Proton GM-1563	Proton GM-1563M	Presario 1500	Smile CA1507	Dell VS15X	Impression 5528NG
Diagonal screen size claimed/measured (inches)	14, 13.5	14, 13.8	15, 14	15, 13.5	15, 13.5	15, 13.5	15, 14	15, 14
CD-ROM drive	Mitsumi CRM-FX400D	Toshiba XM-5302B	Toshiba XM-5302B	Toshiba XM-5302B	Sony CDU-76E	Goldstar GCD-R5406B	Hitachi CDR-7730	Mitsumi CRM-FX400D
Drive speed and interface	4X ATAPI	4X ATAPI	4X ATAPI	4X ATAPI	4X ATAPI	4X ATAPI	4X ATAPI	4X ATAPI
Sound adapter and interface	Creative Labs Sound Blaster 16	Creative Labs Sound Blaster 16	Creative Labs Sound Blaster 16	Creative Labs Phone Blaster	TrueQ Spatializer 3D	Creative Labs Sound Blaster AWE32	Creative Labs Sound Blaster Vibra 16	Diamond ShockWave
Location	ISA card	ISA card	ISA card	ISA card	Motherboard	ISA card	ISA card	ISA card
Motherboard Components								
Installed external RAM cache and type	256K asynchro- nous	256K pipelined burst	256K asynchro- nous	256K pipelined burst	None	256K synchronous	None	256K asynchro- nous
Motherboard manufacturer	Acer	Intel	ASUSTek	ASUSTek	Compaq	Super Micro	Intel	ASUSTek
Chip set manufacturer and model	Intel Triton	Intel Triton	Intel Triton	Intel Triton	OPTi Viper-M	Intel Triton	Intel Triton	Sis 85C496, 85C497
BIOS manufacturer (date and/or version)	Acer (7/4/95, 2.0)	AMI (5/5/95, 1.00.02.BS0)	Award (4/20/95, 4.50PG)	Award (7/4/95)	Compaq (8/17/95, 3.09)	AMI (10/10/94)	AMI/Dell (A00)	Award (8/8/95)
Flash BIOS/16550 UART chip	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Expandability								
Maximum RAM	128MB	128MB	128MB	128MB	128MB	128MB	128MB	128MB
Expansion-bus slots	3 ISA, 2 PCI, 1 PCI/ISA	3 ISA, 2 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 1 PCI, 1 PCI/ISA	4 ISA, 4 PCI	2 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 2 PCI, 1 PCI/ISA
Accessible drive bays (5.25", 3.5")	2, 1	3, 2	5, 1	3, 2	3, 1	3, 2	3, 1	3, 2
Internal drive bays (5.25", 3.5")	2, 1	0, 1	0, 3	0, 2	0, 1	0, 2	0, 2	0, 0
Power-supply wattage	145W	250W	230W	250W	240W	210W	230W	200W
Parallel, serial, mouse ports	1, 2, 1	1, 2, 0	1, 2, 0	1, 2, 0	1, 2, 1	1, 2, 0	1, 2, 1	1, 2, 0
EPP/ECP parallel interfaces supported	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Software								
Integrated	Microsoft Works	Microsoft Works	Microsoft Works	Microsoft Works	Microsoft Works	Microsoft Works	Microsoft Office '95	None
Windows front end	A.C.E.	None	None	None	Presario Gallery	None	None	None
Finance	Quicken SE	Microsoft Money	Microsoft Money	None	Quicken	None	Quicken	None
Reference	Family Doctor, InfoPedia	Microsoft Encarta '95	Microsoft Encarta '95	Microsoft Encarta '95	Family Mayo Clinic, Microsoft Encarta '95	Microsoft Encarta '95	Mayo Clinic	None
Setup and Peripherals								
Speakers	Aurasound	Altec Lansing ACS5	MIDI Land MLI-691H	Integrated on monitor	Presario 1500	MIDI Land MLI-95	Altec Lansing ACS5	Diamond PS-201S
Microphone/Headphones/Joystick	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Fax modem	CIS 28.8 TAD ST 1.XX	Wisecom WS-1414IV1	Archtek SmartLink	Creative Labs Phone Blaster	Compaq Presario 192	Maxtech CL-1414HVF	US Robotics Sportster 28800	Accex WS-1414IV1
Modem speed (data/fax)	28.8/28.8 Kbps	14.4/14.4 Kbps	14.4/14.4 Kbps	14.4/14.4 Kbps	19.2/14.4 Kbps	14.4/14.4 Kbps	28.8/28.8 Kbps	14.4/14.4 Kbps
Setup poster/Getting-started video	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Labeled ports/Color-coded cables	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Service and Support								
7-day, 24-hour live technical support	■	■	■	■	■	■	■	■
Standard warranty on parts/labor	3 years/1 year	1 year/1 year	1 year/1 year	1 year/1 year	3 years/3 years	1 year/1 year	3 years/1 year	1 year/1 year
On-site service charge (first year)	Included	Included	\$109.95	\$75	Included	\$25	Included	\$30

N/A—Not applicable; The vendor does not offer on-site service for this unit.

Digital Starion 920	DirectWave Blue Thunder P1008MVP	Gateway P5-75 Family PC	GST/Micro City Asapogee 8000Pt	HP Pavilion	IBM Aptiva M51	IPC Austin PowerPlus 75	Mega Horizon MPC57516D	Micro Express MicroFlex PCI/P100 Home	Micron P90 Home PC
\$2,598 (list)	\$2,395 (street)	\$2,513 (street)	\$2,495 (street)	\$2,500 (street)	\$2,649 (street)	\$2,499 (street)	\$2,280 (street)	\$2,199 (street)	\$2,518 (street)
Mini-tower	Mini-tower	Desktop	Mini-tower	Mini-tower	Desktop	Mini-tower	Desktop	Mini-tower	Mini-tower
Pentium/75	Pentium/100	Pentium/75	Pentium/100	Pentium/75	Pentium/100	Pentium/75	Pentium/75	Pentium/100	Pentium/90
16MB	16MB EDO	16MB EDO	16MB	16MB	16MB	16MB	16MB	16MB EDO	16MB EDO
1.2GB EIDE	1GB Fast ATA-2	696MB EIDE	1GB Fast ATA-2	1.2GB EIDE	1GB Fast ATA-2	811MB EIDE	811MB EIDE	1GB Fast ATA-2	812MB EIDE
Integrated (S3 Trio32 chip set)	Diamond Stealth64 DRAM	STB Powergraph 64 PCI	Diamond Stealth64 Video VRAM	Integrated (S3 Trio32 chip set)	Integrated (Trident TGV19680 chip set)	ATI Graphics XPression	Diamond Stealth64 Video VRAM	ATI Graphics XPression	Diamond Stealth64 TRIO
1MB DRAM	2MB DRAM	2MB DRAM	2MB VRAM	1MB DRAM	2MB DRAM	2MB DRAM	2MB VRAM	1MB DRAM	2MB DRAM
DEC PCXBY-RL	Princeton Graphics Ultra 15	Sony Vivitron 1572DGM	Aurora Vision SM583	HP D3857A	IBM 15 RMS	Smile MN2408B	MGC DCM-1588	GVC M1566	ADI MicroScan 4V
15, 13.8	15, 13.5	15, 14	15, 13.5	15, 14	14, 13.5	15, 13.5	15, 13	15, 14	15, 13.5
Mitsumi CRMC-FX400	Mitsumi CRMC-FX400B	Sanyo CDR-3CG	Toshiba XM-5302B	Mitsumi CRMC-FX400B	Mitsumi CRMC-FX400C3	Toshiba XM-5302B	Toshiba XM-5302B	Toshiba XM-5302B	Sony CDU-76E
4X ATAPI	4X ATAPI	4X ATAPI	4X ATAPI	4X ATAPI	4X ATAPI	4X ATAPI	4X ATAPI	4X ATAPI	4X ATAPI
Diamond Multimedia Telecommander	Creative Labs	Creative Labs Sound Blaster Vibra 16	Vibra 16	Crystal CS 4232	Spectrum MWave	Media Magic Telemetry 32	Creative Labs Sound Blaster 16	Creative Labs Sound Blaster 32	Creative Labs Sound Blaster Vibra 16
ISA card	ISA card	ISA card	Motherboard	Motherboard	ISA card	ISA card	ISA card	ISA card	ISA card
None	256K pipelined burst	None	256K pipelined burst	256K asynchronous	256K synchronous	256K asynchronous	256K asynchronous	256K pipelined burst	256K asynchronous
Digital	ASUSTek	Intel	Intel	Intel	IBM	Intel	BCM Research	Tyan	Micronics
S/S 85C501, 85C502, 85C503	Intel Triton	Intel Triton	Intel Triton	Intel Triton	OPTi Viper-M	Intel Triton	Intel Triton	Intel Triton	Intel Triton
Phoenix (8/23/95, 1.02)	Award (01.10)	AMI (1.00.03.BSOT)	AMI (1.00.02.CB0)	AMI (8/03/95, 1.00.09.BTOL)	Phoenix (9/5/95, 0.02)	AMI (5/10/95, 1.00.02BS0)	Award (8/8/95)	Award (4.05G)	Phoenix (8/15/95, 4.04)
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
128MB	128MB	128MB	128MB	128MB	128MB	128MB	128MB	128MB	128MB
3 ISA, 1 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 2 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	5 ISA, 2 PCI	1 ISA, 2 PCI/ISA	2 ISA, 2 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	4 ISA, 4 PCI	3 ISA, 3 PCI, 1 PCI/ISA
3, 1	3, 2	3, 1	3, 2	3, 1	1, 1	3, 2	3, 2	3, 2	3, 1
0, 0	0, 2	0, 2	0, 2	0, 3	0, 1	0, 2	0, 2	0, 2	0, 2
200W	200W	145W	250W	200W	145W	200W	250W	200W	200W
1, 1, 1	1, 2, 0	1, 2, 1	1, 2, 0	1, 2, 1	1, 2, 1	1, 2, 0	1, 2, 0	1, 2, 0	1, 2, 1
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Microsoft Works	None	Microsoft Works	Microsoft Works	Microsoft Works	Microsoft Works	None	Microsoft Works	Microsoft Works	Microsoft Works
Getting Started	None	None	None	Personal Page	Aptiva Guide	None	None	None	Microsoft Bob
Quicken	None	Microsoft Money	None	Microsoft Money	Quicken SE, Wall Street Money	None	Microsoft Money	Microsoft Money	Quicken
Explorapedia, Microsoft Bookshelf, Microsoft Encarta '95	None	Family Pharmacy, Microsoft Encarta '95	Microsoft Encarta '95	Microsoft Encarta '95	Compton's Interactive-Encyclopedia	None	Microsoft Encarta '95	Microsoft Encarta '95	Computer Select SE
JBL	MIDI Land MLI-95	Altec Lansing ACS5	Level EP-280	Altec Lansing HP Audio System	IBM Aptiva 30	Jazz J-307A	Multi-Media EP-120	Labtec LCS-1400	Jensen JPS45
■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Diamond Telecommander 2300	Archtek SmartLink	US Robotics Telepath11V	Maxtech F-1114H/R7	Prometheus Zepher	Spectrum MWave	Media Magic Telemetry-32	Archtek WS-1414IV1	Apache Micro Peripheral V341-V	Prometheus Cyberphone
14.4/14.4 Kbps	14.4/14.4 Kbps	28.8/14.4 Kbps	14.4/14.4 Kbps	14.4/14.4 Kbps	28.8/14.4 Kbps	19.2/14.4 Kbps	14.4/14.4 Kbps	28.8/14.4 Kbps	14.4/14.4 Kbps
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
■	■	■	■	■	■	■	■	■	■
3 years/1 year Included	1 year/lifetime \$45	3 years/1 year Included	3 years/3 years Included	1 year/1 year Included	3 years/3 years N/A	1 year/1 year Included	1 year/1 year N/A	2 years/2 years \$50	1 year/1 year Included

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SPECIFICATIONS

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PCI Bus architecture

8-40MB RAM

810MB/1.3GB HDD

Video graphics accelerator

Swappable CD-ROM/FDD optional 2nd HDD/
optional 2nd battery

10.4" and 11.3" TFT SVGA and 11.3" DSTN SVGA displays

Extended battery life with NiMH or Lithium Ion

Designed for Windows 95

NTSC/PAL video out for TV connect

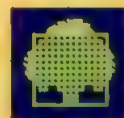
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SUMMARY OF FEATURES

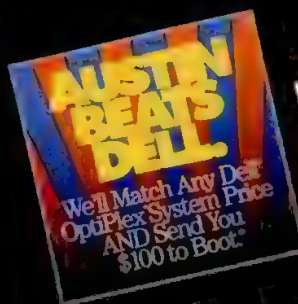
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Home PCs

	Micro Professionals Pro- teva 100 Super Multimedia	MidWest Micro P590 Home PC	Multiwave SOHO MPEG System	NEC Ready 9022	NETiS N575 Media	Packard Bell Pentium 100 Designer Tower	PerComp P75 MediaPro
Price of tested configuration	\$2,499 (street)	\$2,499 (street)	\$1,995 (street)	\$2,099 (street)	\$2,095 (street)	\$2,849 (street)	\$2,499 (street)
Case type	Tower	Mini-tower	Mini-tower	Mini-tower	Desktop	Mini-tower	Desktop
Processor	Pentium/100	Pentium/90	Pentium/100	Pentium/100	Pentium/75	Pentium/100	Pentium/75
Installed RAM	16MB EDO	16MB EDO	16MB	16MB	16MB	16MB EDO	16MB EDO
Hard disk capacity and interface	1.2GB EIDE	1GB Fast ATA-2	1.2GB EIDE	1GB EIDE	1.5GB EIDE	1.6GB EIDE	1.2GB EIDE
Graphics adapter	Diamond Stealth64 Video VRAM	ATI Winturbo	STB Powergraph 64 PCI	Integrated (Alli- ance ProMotion 6422 chip set)	ATI Winturbo	Integrated (Cirrus Logic GD5434J chip set)	Diamond Stealth64 Video VRAM
Memory	2MB VRAM	2MB VRAM	1MB DRAM	1MB DRAM	2MB VRAM	1MB DRAM	2MB DRAM
Monitor	MAG Innovision DX15Fe	Infotel SRC1502L	AcerView 55/55L	NEC JC- 1538VMA	Proton GM- 1563M	Packard Bell 1511	JM Computers DCM 1588 E
Diagonal screen size claimed/measured (inches)	15, 14	15, 13.5	15, 13.5	15, 13.5	15, 14	15, 13.5	15, 13.5
CD-ROM drive	Acer 645A	Acer 645A	Acer 645A	Mitsumi CRM-CFX400	Acer C645	Matsushita CR574-B	Toshiba XM-5302B
Drive speed and interface	4X ATAPI	4X ATAPI	4X ATAPI	4X ATAPI	4X ATAPI	4X ATAPI	4X ATAPI
Sound adapter and interface	ESS Audician 16P	Aztec Waverider	Creative Labs Phone Blaster	OPTi 16	Creative Labs Sound Blaster Vibra 16	Packard Bell	Creative Labs Phone Blaster
Location	ISA card	ISA card	ISA card	Motherboard	ISA card	ISA card	ISA card
Motherboard Components							
Installed external RAM cache and type	256K synchronous	256K asynchro- nous	256K asynchro- nous	256K asynchro- nous	256K synchronous	None	256K pipelined burst
Motherboard manufacturer	First International	Intel	Acer	NEC/BCM	First International	Intel	Plus Data
Chip set manufacturer and model	Intel Triton	Intel Triton	Intel Triton	Intel Triton	Intel Triton	Intel Triton	Intel Triton
BIOS manufacturer (date and/or version)	Award (9/07/95, 4.50PG)	AMI (5/5/95)	AMI (10/10/94)	Phoenix (6/95, 4.05)	Award (4.50PG)	AMI (100.5)	Award (7/21/95, 4.50G)
Flash BIOS/16550 UART chip	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Expandability							
Maximum RAM	128MB	128MB	128MB	128MB	128MB	128MB	128MB
Expansion-bus slots	3 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 2 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 1 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 2 PCI, 1 PCI/ISA	4 ISA, 4 PCI
Accessible drive bays (5.25", 3.5")	4, 1	3, 2	3, 2	3, 1	3, 2	3, 1	3, 1
Internal drive bays (5.25", 3.5")	0, 4	0, 3	0, 2	0, 1	0, 2	0, 1	0, 2
Power-supply wattage	250W	230W	250W	200W	230W	150W	230W
Parallel, serial, mouse ports	1, 2, 0	1, 2, 0	1, 2, 0	1, 2, 1	1, 2, 0	1, 1, 1	1, 2, 0
EPP/ECP parallel interfaces supported	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Software							
Integrated	Novell's Perfect Office	Microsoft Works	Microsoft Works	Microsoft Works	Microsoft Works	Microsoft Works	Microsoft Works
Windows front end	None	Microsoft Bob	None	Microsoft Bob	None	Navigator	None
Finance	None	Microsoft Money	Microsoft Money	Quicken	Microsoft Money	Microsoft Money	None
Reference	Compton's Interactive Encyclopedia	Microsoft Encarta '95	Microsoft Encarta '95	Explorapedia, Microsoft Encarta '95	Microsoft Encarta '95	Microsoft Encarta '95, My First Encyclopedia, Reference Library for IBM PC's	Family Doctor, Microsoft Encarta '95, World Literary Heritage
Setup and Peripherals							
Speakers	Touch Active SP-690	Altec Lansing ACS31	Creative Labs SBS30	MIDI Land MLI-691H	Integrated on monitor	Integrated on monitor	MIDI Land MLI-95
Microphone/Headphones/Joystick	⚡ ⚡ ⚡	⚡ ⚡ ⚡	■ ⚡ ⚡	■ ⚡ ⚡	⚡ ⚡ ⚡	■ ⚡ ⚡	■ ⚡ ⚡
Fax modem	GVC WS-281412	Infotel 1491	Creative Labs Phone Blaster	Boca FDVSP34I	Zoltrix FM-8818	Packard Bell	Creative Labs Phone Blaster
Modem speed (data/fax)	28.8/14.4 Kbps	28.8/14.4 Kbps	14.4/14.4 Kbps	28.8/28.8 Kbps	14.4/14.4 Kbps	14.4/14.4 Kbps	14.4/14.4 Kbps
Setup poster/Getting-started video	⚡ ⚡	⚡ ⚡	⚡ ⚡	■ ⚡	⚡ ⚡	■ ⚡	⚡ ⚡
Labeled ports/Color-coded cables	⚡ ⚡	⚡ ⚡	■ ⚡	⚡ ⚡	■ ⚡	■ ⚡	■ ⚡
Service and Support							
7-day, 24-hour live technical support	⚡	⚡	⚡	■	⚡	■	■
Standard warranty on parts/labor	1 year/1 year	3 years/3 years	1 year/1 year	3 years/3 years	1 year/3 years	1 year/1 year	1 year/1 year
On-site service charge (first year)	Included	N/A	\$30	Included	Included	Included	Included

N/A—Not applicable: The vendor does not offer on-site service for this unit

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PC Magazine, Editor's Choice Awards, May 30, 1995 Issue

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15" .28 NI SVGA Monitor
Energy-Star Compliant
Windows '95 Pre-Installed

MULTIMEDIA SYSTEM **\$2,399**

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- 4X IDE CD-ROM Drive
- 16-Bit Audio Card, Stereo Speakers
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- 4X IDE CD-ROM Drive
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- MS Office '95 Standard — CD
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Austin Pentium Technology Notebooks

BUSINESS AUDIO™ XP-75
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Parallel, Serial, Keyboard, IRDA, SVGA Ports
Lithium Ion Battery
Weight with Battery: 5.5 lbs.
One-Year Parts & Labor Warranty
Win '95 Plug n' Play BIOS
MS Office 95 Standard
Windows 95 Pre-Installed

BUSINESS AUDIO XP P5-75 **\$3,048**

- 75MHz Intel Pentium Processor
- Intel Mobile Triton™ PCI Bus
- 10.4" DSTN Color Display
- 8MB RAM (expandable to 24MB)
- 814MB Hard Drive (32-Bit Local Bus IDE)
- 32-Bit PCI Video - 1MB
- Internal 3.5" Diskette Drive
(Removable for optional second battery)
- Business Lease: \$117/month

BUSINESS AUDIO P-90
Built-in Microphone and Speaker,
External Jacks for Line-In/Line-Out
Internal 3.5" Diskette Drive
Integrated Pointing Device
2 Type II or 1 Type III PCMCIA Slots
Parallel, Serial, Keyboard, IRDA, SVGA Ports
Weight with Battery: 5.5 lbs.
One-Year Parts & Labor Warranty
MS Office 95 Standard
Windows 95 Pre-Installed

BUSINESS AUDIO P5-90 **\$3,999**

- 90MHz Intel Pentium Processor
- 256K 64-Bit L2 Cache
- 10.2" TFT 800x600 SVGA Color Display
- 16MB 64-Bit RAM (expandable to 40MB)
- 1.3GB Hard Drive (Local Bus IDE)
- 14.4 Fax Modem with Online Services
- Business Lease: \$153/month



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Parallel, Serial, Keyboard, IRDA, SVGA Ports
Weight with Battery: 5.5 lbs.
One-Year Parts & Labor Warranty
Win '95 Plug n' Play BIOS
MS Office 95 Standard
Windows 95 Pre-Installed

Up to 11.3" Dual Scan Color Display
Built-in Microphone and Speaker
External Jacks for Line-In/Line-Out
Internal 3.5" Diskette Drive
Integrated Pointing Device
2 Type II or 1 Type III PCMCIA Slots
Parallel, Serial, Keyboard, SVGA Ports
Weight with Battery: 6.5 lbs.
One-Year Parts & Labor Warranty
MS Office 95 Standard
Windows 95 Pre-Installed

BUSINESS AUDIO XL XL 486DX4-75 \$2,349

- 75MHz Intel 486 DX4 Processor
- 10.4" DSTN Color Display
- 8MB RAM (expandable to 20MB)
- 262MB Hard Drive
- Internal 3.5" Diskette Drive (Removable for optional second battery)
- Business Lease: \$90/month

VISTA 486 DX4-100 \$2,220

- 100MHz Intel 486DX4 Processor
- 11.3" DSTN Color Display (Local Bus Video)
- 8MB RAM (expandable to 28MB)
- 814MB Hard Drive (Local Bus IDE)
- Business Lease: \$85/month



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SUMMARY OF FEATURES

Home PCs

Ends

■ YES ■ NO

In alphabetical order by company

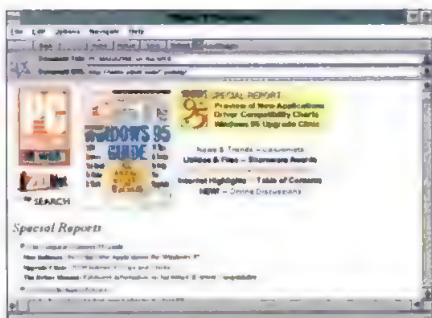
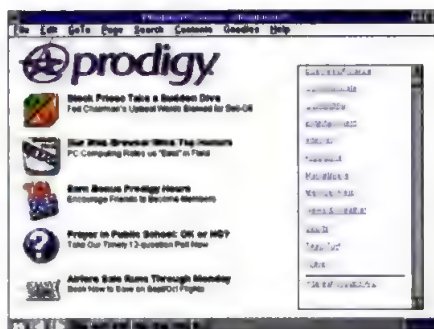
	Polywell Poly 500P	Quantex QP5/100 M-4	Robotech Cobra XLT75 Home Office	Treasure Chest TCP575	Tri-Star Tri-CAD Multimedia	USA FlexPT-90 Home Multi-media System	Vektron Multi-media Home
Price of tested configuration	\$2,499 (street)	\$2,299 (street)	\$2,499 (street)	\$2,295 (list)	\$2,495 (street)	\$2,395 (street)	\$2,569 (street)
Case type	Mini-tower	Mini-tower	Tower	Mini-tower	Mid-tower	Mini-tower	Mini-tower
Processor	Pentium/100	Pentium/100	Pentium/75	Pentium/75	Pentium/75	Pentium/90	Pentium/100
Installed RAM	16MB	16MB	16MB	16MB EDO	16MB	16MB EDO	16MB
Hard disk capacity and interface	1GB Fast ATA-2	1 2GB EIDE	1GB Fast ATA-2	813MB EIDE	1.2GB EIDE	813MB EIDE	1 2GB EIDE
Graphics adapter	Diamond Stealth64 Video VRAM	STB Powergraph 64 PCI	Number Nine 9FX Vision 330	Diamond Stealth64 DRAM	Tri-CAD DFI WG 3120P	WD Paradise Bahamas 64 PCI	Diamond Stealth64 Video VRAM
Memory	2MB DRAM	2MB DRAM	1MB DRAM	2MB DRAM	2MB DRAM	2MB DRAM	2MB VRAM
Monitor	SAMPO KDM-1566	MAG Innovision DX15Fe	Cobra SM584	MAG Innovision DX15Fe	ADI MicroScan 4GP	Qume QM-1570DES	ADI MicroScan 4V
Diagonal screen size claimed/measured (inches)	15, 13.5	15, 13.5	15, 14	15, 14	15, 13.5	15, 14	15, 13
CD-ROM drive	Panasonic CR-574-B	Toshiba XM-5302B	Creative CR574-B	Mitsumi CRM-C-FX400D	Mitsumi CRM-C-FX400	Toshiba XM-5302B	Media Vision 8322 IDE
Drive speed and interface	4X ATAPI	4X ATAPI	4X ATAPI	4X ATAPI	4X ATAPI	4X ATAPI	6X ATAPI
Sound adapter and interface	Creative Labs Sound Blaster 16	Ensoniq Soundscape	Cobra Wave Table	Creative Labs Sound Blaster 16	DFI Orchestra-16	Turtle Beach MonteCarlo	Creative Labs Sound Blaster AWE32
Location	ISA card	ISA card	ISA card	ISA card	ISA card	ISA card	ISA card
Motherboard Components							
Installed external RAM cache and type	256K pipelined burst	256K pipelined burst	256K pipelined burst	256K pipelined burst	256K asynchronous	256K pipelined burst	256K synchronous
Motherboard manufacturer	Priam	Biostar	Robotech	ASUSTek	Area	Plus Data	Super Micro
Chip set manufacturer and model	Intel Triton	Intel Triton	SiS 85C501, 85C502, 85C503	Intel Triton	Intel Triton	Intel Triton	Intel Triton
BIOS manufacturer (date and/or version)	Award (6/6/95, 4.50G)	Award (7/18/95)	Award (6/13/95, 4.50PG)	Award (7/4/95, 4.50PG)	Award (7/18/95, 4.50PG)	Award (6/21/95, 4.50PG)	AMI (10/10/94)
Flash BIOS/16550 UART chip	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Expendability							
Maximum RAM	128MB	128MB	128MB	128MB	128MB	128MB	128MB
Expansion-bus slots	4 ISA, 4 PCI	3 ISA, 2 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 2 PCI, 1 PCI/ISA	4 ISA, 4 PCI	4 ISA, 4 PCI
Accessible drive bays (5.25", 3.5")	4, 2	4, 1	4, 1	3, 1	3, 2	3, 2	2, 2
Internal drive bays (5.25", 3.5")	0, 2	0, 2	0, 3	0, 4	0, 2	0, 2	0, 1
Power-supply wattage	230W	200W	250W	250W	200W	230W	250W
Parallel, serial, mouse ports	1, 2, 0	1, 2, 0	1, 2, 0	1, 1, 0	1, 2, 0	1, 2, 0	1, 2, 0
EPP/ECP parallel interfaces supported	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Software							
Integrated	Microsoft Works	Microsoft Works, Novell's Perfect Office	Microsoft Works, WordPerfect Works	Novell's Perfect Works	Microsoft Works	Microsoft Works	Microsoft Works
Windows front end	PolyVision	None	Button	None	None	None	None
Finance	Microsoft Money	Quicken Financial Suite	Quicken Deluxe	Quicken	None	Microsoft Money	None
Reference	Microsoft Encarta '95	Mayo Clinic, Microsoft Encarta '95	Cinemania '95	Compton's Interactive Encyclopedia	Microsoft Encarta '95	CNN Newsroom Global View, World Atlas	Compton's Interactive Encyclopedia, Microsoft Encarta '95
Setup and Peripherals							
Speakers	Yamaha YST-M5	Altec Lansing ACS5	Creative Labs 8BS38	Altec Lansing ACS31	MIDI Land ML-691H	Altec Lansing ACS31	Yamaha YST-M5
Microphone/Headphones/Joystick	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Fax modem	GVC 144INT	Askey International CL-1414HVF	BocaModem	Pacific Image CL-1414 HVF	Microdirect 144FX	Boca Voice View	Supra Fax Modem 288i
Modem speed (data/fax)	14.4/9.6 Kbps	14.4/14.4 Kbps	14.4/14.4 Kbps	14.4/14.4 Kbps	14.4/14.4 Kbps	14.4/14.4 Kbps	28.8/14.4 Kbps
Setup poster/Getting-started video	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Labeled ports/Color-coded cables	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Service and Support							
7-day, 24-hour live technical support	■	■	■	■	■	■	■
Standard warranty on parts/labor	3 years/5 years	1 year/1 year	2 years/lifetime	2 years/2 years	2 years/lifetime	1 year/lifetime	1 year/lifetime
On-site service charge (first year)	\$75	Included	Included	N/A	\$49	\$50	\$50

N/A—Not applicable. The vendor does not offer on-site service for this unit.

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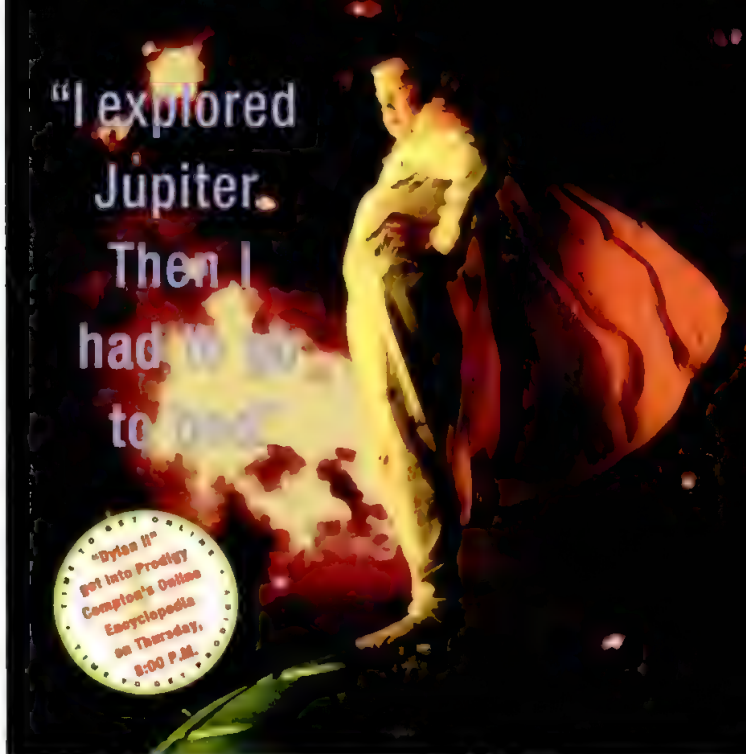
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Digital Equipment Corp.

Starion 920

Digital Equipment Corp.'s \$2,598 Starion 920 is marketed as a general-purpose family machine. The 75-MHz Pentium-based PC rates high in user comfort features, has good sound, and was able to run all tested software titles without a hitch. On our benchmark tests, however, it was a below-average performer.

Setup is aided by an easy-to-follow poster, and a toll-free support number is printed on the mouse pad. A custom Windows front end, Getting Started, organizes your software into productivity, multimedia, and educational groups. Digital's software bundle includes Quicken SE and Microsoft Bookshelf, as well as software to use the system's 14.4-Kbps modem as a voice

mail and fax center.

A slow hard disk and lack of L2 cache contributed to the unit's low benchmark test scores, some of which were the lowest of its CPU group (Digital says a speedier Maxtor disk will be standard by the time you read this). Video-sampling tests

SUITABILITY TO TASK	
Setup	Good
Entertainment	Fair
Productivity	Good

SERVICE & RELIABILITY

Digital Equipment Corp.

Reliability	Better than average
Repair	Better than average
Technical support	Better than average
Percent needing repair	Better than average



showed smearing and a high number of dropped frames. But the news wasn't all bad: The JBL speakers produced rich sound with only minimal bass distortion.

A warranty covers parts for three years and labor for one. On-site service is provided for the first year.—BB

Digital Equipment Corp., Acton, MA; 800-216-8115, 508-624-6400; fax, 800-388-3228; www.pc.digital.com.

Circle 464 on reader service card

DirectWave Inc.

Blue Thunder P100BMVP

DirectWave's \$2,395 Blue Thunder P100BMVP is a PC that will satisfy all types of home users, from power users seeking great performance to those looking for fun and useful software. Depending on your needs, DirectWave will bundle either a home-office or en-

SUITABILITY TO TASK	
Setup	Good
Entertainment	Good
Productivity	Good



tertainment software package.

Although there was no setup guide, all of the unit's ports were labeled and a video was included to make the process easier. Other accessories included a microphone, headphones, and a joystick.

Our test unit included the entertainment package. It features such software titles as ChessMaster 4000, Grolier's Multimedia Encyclopedia, and U.S. and World Atlas. The home-office user can choose the Microsoft Home Pack instead at no additional cost. (You can get both packages for an additional \$69.) For \$200 more, you can get a sextuple-speed CD-ROM drive plus Lotus SmartSuite and Organizer.

The Blue Thunder P100BMVP was an outstanding performer on our battery of benchmark tests, posting scores at the top of its Pentium/100 CPU group on all Windows-based tests. Our panel of listeners found the Midi Land MLI-95 speakers to be slightly above average, and the unit had no difficulty with our compatibility tests.

DirectWave includes a one-year warranty on parts with free lifetime labor. On-site service for one year costs \$45.—WPF
DirectWave Inc., Ontario, CA; 800-882-8108, 909-390 8098; fax, 909-390-8061; drctwave@ix.netcom.com.

Circle 465 on reader service card

Gateway 2000 Inc.

Gateway P5-75 Family PC

The \$2,513 Gateway P5-75 Family PC is marketed as a fully equipped entry-level PC for all home uses. The Pentium/75-based PC performed well on benchmark and compatibility tests and earns high marks for its setup aids.

The P5-75 comes with the Gateway Generations software package, a 9-CD, 51-title extravaganza that includes Microsoft Bookshelf 95, Encarta 95, and Money. (This is the only software bundle available with this unit; for productivity software you must buy Gateway's Best Buy PC.)

The system has a 28.8/14.4-Kbps fax modem with telephone answering software. Gateway's front end—the Gateway 2000 Information Highway—lets you pick between on-line services and the Internet.

The Altec Lansing ACS-5 speakers worked very well with the unit's Sound Blaster 16 card, producing clear sound for both audio CDs and CD-ROM software. All titles installed and ran without problems in our software-compatibility testing.

The Gateway P5-75 Family PC doesn't have L2 cache, so test results were average for its CPU group. The unit did well in video clip testing, dropping only a few frames in the full-screen test.

Gateway's Gold service includes a three-year warranty with one year of on-site service.—BB

Gateway 2000 Inc., North Sioux City, SD; 800-846-2000, 605-232-2000; fax, 605-232-2023.

Circle 466 on reader service card

SUITABILITY TO TASK	
Setup	Excellent
Entertainment	Good
Productivity	Good

SERVICE & RELIABILITY

Gateway 2000 Inc.

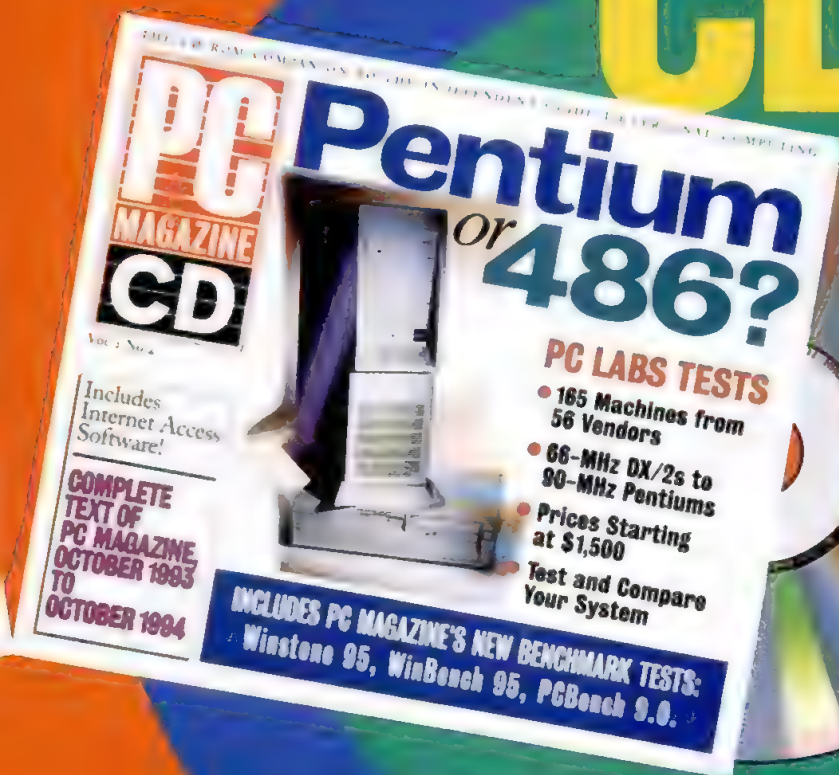
Reliability	Better than average
Repair	Better than average
Technical support	Better than average
Percent needing repair	Average



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GST/Micro City Inc.

Aapogee 8000Pt

GST/Micro City aims the \$2,495 Aapogee 8000Pt at computer-literate home-office power users. This system should satisfy its target audience: Its performance on our benchmark tests was strong—highlighted by an above-average score on our Winstone 96 tests. The Aapogee also earns kudos for software compatibility: The system installed and ran all titles without a hitch.

The Aapogee lacked a setup guide, but given its target audience, this shouldn't be a problem. But in case you do need help, GST/Micro City's toll-free technical support number is posted on the system's case.

The software pack we received, which included U.S. and World Atlas and San Diego Zoo's Animals, will no longer be offered by the time you read this. GST/Micro City will offer instead either the Microsoft Family Bundle for an additional \$69 or a Productivity pack for \$99.

The system posted an above-average score on our Winstone 96 tests and was on a par with the other Pentium/100 PCs

SUITABILITY TO TASK	
Setup	Good
Edutainment	Good
Productivity	Good

on our Disk WinMark 96 and Graphics WinMark 96 tests. The unit successfully



completed our software-compatibility tests, and our jury of listeners found its GST EP-280 speakers to be adequate.

GST/Micro City covers the Aapogee 8000Pt with a three-year parts-and-labor warranty that includes on-site service for the first year.—WPF

GST/Micro City Inc., Cerritos, CA; 800-567-2764, 714-739-0106; fax, 714-739-8291; gst@primenet.com.

Circle 467 on reader service card

Hewlett-Packard Co.

HP Pavilion

Hewlett-Packard's \$2,500 Pavilion mini-tower is not your usual PC. Good performance on all objective and subjective tests showed that this machine is correctly targeted at the whole range of home computer users.

The Pavilion's case, designed for HP by Lunar Design, bulges in front and has a indentation for



the power button and status lights. The 15-inch monitor has detachable Altec Lansing speakers, a microphone, a headphone jack, a volume control, and a mute button.

Setup is easy. A colorful two-sided poster covers component installation on one side and HP's Personal Page, a Windows front end, on the other.

The bundled software focuses on family reference, educational, and entertainment packages. HP's FaxPhone software hooks the 14.4-Kbps modem to a family voice mail system.

The Pentium/75-based Pavilion was an average performer on our benchmark tests, except for a below-average Graphics WinMark 96 score. Subjective testing showed smooth motion in all image sizes and only minor frame dropping. There were no software-compatibility problems.

A one-year parts-and-labor warranty includes on-site service. Hewlett-Packard offers tech support 24 hours, 7 days.—BB
Hewlett-Packard Co., Palo Alto, CA; 800-724-6631, 810-357-1219; fax, 810-357-1317; www.hp.com.

Circle 468 on reader service card

SUITABILITY TO TASK	
Setup	Excellent
Edutainment	Good
Productivity	Good

SERVICE & RELIABILITY

Hewlett-Packard Co.	
Reliability	Better than average
Repair	Better than average
Technical support	Better than average
Percent needing repair	Better than average

IBM Personal Computer Co.

Aptiva M51

IBM has created a near-perfect home PC in the \$2,649 Aptiva M51. Geared for family and educational use, this 100-MHz unit includes quality entertainment, educational, and productivity software.

The Aptiva is easy to set up: System ports are labeled, and a detailed Read Me First booklet is included. The Aptiva Guide is activated once you turn on your system and offers programs such as a tutorial to help you get to know your PC.

The system comes with a combination 16-bit sound board and 28.8-/14.4-Kbps data/voice modem. IBM includes an adapter cord with two plugs so you can run your modem and phone from the same jack. MPEG is supported through software and Trident's TGUI9680 video chip set.

The system ran smoothly during software-compatibility trials. The Aptiva's performance on our Windows-based benchmark tests was average, though the PC did turn in an above-average Disk WinMark 96 score. It also had good video playback.

Bundled software includes Compton's Multimedia Encyclopedia and Quicken for Windows. IBM's Communications Center provides answering machine, full-duplex speakerphone, and fax functions.

The Aptiva is covered by a three-year warranty.—Anush Yeghazarian

IBM Personal Computer Co., Research Triangle Park, NC; 800-426-2968; fax, 800-426-3395; IBM.com. Circle 469 on reader service card

SUITABILITY TO TASK	
Setup	Good
Edutainment	Good
Productivity	Excellent

SERVICE & RELIABILITY

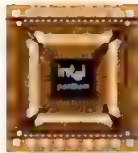
IBM PC Co.	
Reliability	Better than average
Repair	Better than average
Technical support	Better than average
Percent needing repair	Better than average



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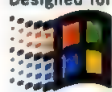
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IPC Technologies Inc.

Austin PowerPlus 75

The \$2,499 Austin PowerPlus 75 is aimed at people who want a multimedia PC for the whole family to use. Unfortunately, the machine was troubled by weak speakers, marginal video-clip performance, and sporadic software-compatibility problems.

The PowerPlus 75 included a Read Me First quick-installation sheet. Bundled software consisted of several games, on-line start-up kits, and Synchro's Multimedia Connect voice and fax mail system.

The PowerPlus 75 came with a Media Magic Telemetry 32 combination wavetable sound and 19.2-/14.4-Kbps data/fax/voice modem card. Graphics were handled by the ATI Graphics Expression board with 2MB of DRAM.

In our software-compatibility tests, the PowerPlus 75 had some problems with Doom, but all other titles ran well. Benchmark test results were average for the unit's CPU class, except for a below-average Disk WinMark 96 score.

The Jazz speakers suffered from weak bass and distortion in high ranges. In full-motion video-clip testing, the full-screen mode demonstrated frame dropping and blocky images.

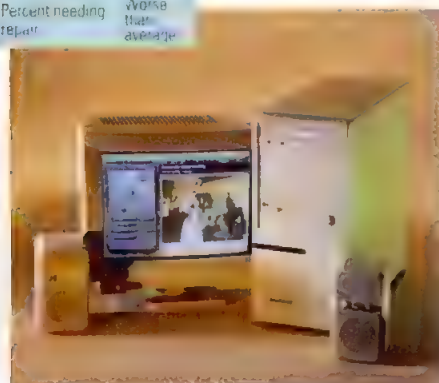
A one-year warranty includes on-site service. Toll-free technical support is available 24 hours, 7 days.—RSA

SUITABILITY TO TASK	
Setup	Good
Edutainment	Fair
Productivity	Fair

SERVICE & RELIABILITY	
IPC Technologies Inc.	
Reliability	Average
Repair	Average
Technical support	Average
Percent needing repair	Worse than average

IPC Technologies Inc., Austin, TX; 800-483-9938, 512-339-5003; fax, 512-454-1357; www.ipctech-inc.com.

Circle 470 on reader service card



Mega Computer Systems

Horizon MPC7516D

Intended for use as a home-office PC, the \$2,280 Pentium/75-based Horizon MPC7516D, from Mega Computer Systems, doesn't offer many amenities for first-time users and comes with a skimpy software bundle. The system

SUITABILITY TO TASK	
Setup	Fair
Edutainment	Good
Productivity	Fair



wasn't a strong performer on our benchmark tests, either.

The Horizon's audio system was one of the best we heard, with the Multi-Media EP-120 speakers and Sound Blaster 16 board combining to produce powerful sound. The PC was not quite as proficient with full-motion video: It dropped some frames on our objective video tests, although images were relatively smooth in small- and large-scale video tests.

The system's graphics were controlled by a Diamond Stealth64 Video VRAM card with 2MB of VRAM—a proven achiever. However, a relatively slow 3,600-rpm Conner hard disk contributed not only to a low Disk WinMark 96 score but to a low Winstone 96 score, as well.

There were no problems with software compatibility: The Horizon MPC7516D ran everything we loaded without a hitch. However, home users might be disappointed with the bundled software, which consisted only of Microsoft Home Pack.

The unit comes with a one-year parts-and-labor warranty; on-site service is not available.—BB

Mega Computer Systems, San Diego, CA; 800-338-6628, 619-487-8888; fax, 619-485-1518; michaelim@aol.com.

Circle 471 on reader service card

Micro Express

MicroFlex-PCI/P100/Home

The \$2,199 MicroFlex-PCI/P100/ Home PC may not cater to the home user with custom front ends or quick-setup guides, but the system was easy to set up, and it proved to be a great performer on both our benchmark and multimedia tests. Micro Express targets this 100-MHz Pentium-based PC at home users looking for a reasonably priced, high-performance, multimedia machine that can also be used for entertainment and home-office purposes.

A quick-start chart is included and shows how to connect all components. Microsoft's Home Pack is preinstalled. The system also comes with a 28.8-/14.4-Kbps data/fax modem.

The Labtec LCS-1400 speakers produced very clear and strong mid- and high-range sound—though they were a little weaker on bass sounds. All software titles used for compatibility testing loaded and ran correctly, and video images were smooth, with no frame drops, in our video-clip testing.

With 256K pipelined-burst cache, a Triton chip set, and a 1GB Quantum Fireball hard disk, the MicroFlex system is loaded for heavy action. And its perfor-

SUITABILITY TO TASK	
Setup	Good
Edutainment	Good
Productivity	Excellent



mance delivers: The unit posted above-average scores for its CPU class on all of our Windows-based benchmark tests.

Micro Express warranties its PC for two years and backs it up with 24-hour, 7-day technical support. On-site service costs \$50 per year.—BB

Micro Express, Santa Ana, CA; 800-989-9900, 714-852-1400; fax, 714-852-1225.

Circle 472 on reader service card

Micron Electronics Inc.

P90 Home MPC

If you're looking for a great-sounding home PC, check out Micron Electronics' \$2,518, Pentium/90-based P90 Home MPC. This system's Jensen speakers produced the best sound of all the PCs we tested. Combine that with high marks for software compatibility and solid performance on subjective tests and you have a great PC for home users.

The P90 came with a setup poster and a manual with lots of illustrated directions. Bundled software includes several productivity, educational, and entertainment titles, including Quicken Deluxe.

Our informal sound panel judged the PC's audio system—powered by a Sound Blaster 16 audio card and Jensen JPS 45 speakers—to be the best in this roundup.

An average score on our Graphics WinMark 96 tests complimented the unit's smooth performance on our multimedia tests. In compatibility testing, incorrect MIDI settings prevented some music in Magic School Bus from running; otherwise that program and all other test titles ran perfectly. The PC garnered an average Disk WinMark 96 score but earned a below-average score for its CPU group on

our Winstone 96 tests.

Micron PCs come with a one-year warranty that includes on-site service.—**BB Micron Electronics Inc., Nampa, ID; 800-388-6334, 208-463-3434; fax, 208-463-3424; www.mei.micron.com.**

Circle 473 on reader service card

SUITABILITY TO TASK	
Setup	Good
Edutainment	Good
Productivity	Good

SERVICE & RELIABILITY

Micron Electronics Inc.	
Reliability	Better than average
Repair	Partially average
Technical support	Better than average
Percent needing repair	Average

Micro Professionals Inc.

Proteva 100 Super Multimedia

The \$2,499 Proteva 100 Super Multimedia tower offers solid performance and a good software bundle. Mail-order vendor Micro Professionals (which also resells its systems to other vendors) aims this 100-Mhz Pentium machine at general home users.

The system comes with an owner's manual booklet that includes step-by-step setup instructions and a short Windows 95 tutorial. And the vendor's tech sup-



port number is clearly stated up front.

The Proteva PC did well on our software compatibility tests, and its bundled software offers something for everyone: Novell PerfectOffice (or Lotus SmartSuite), Compton's Multimedia Encyclopedia 95, and three DOS-based games.

The unit performed reasonably well on our multimedia tests, but choppiness was evident on subjective video-playback tests and there was excessive image pixelation. The 16-bit sound card is Sound Blaster-compatible, but the audio system—featuring Touch Active speakers—did not do well on our informal tests. The unit comes with a 28.8-/14.4-Kbps data/fax modem.

The Proteva posted an above-average Graphics WinMark 96 score for its CPU class, an average Winstone 96 score, and a below-average Disk WinMark 96 score.

The system comes with a one-year warranty, with on-site service included.—**AY Micro Professionals Inc., Lansing, IL; 800-800-8300, 708-339-8398; fax, 708-339-8333.**

Circle 474 on reader service card

SUITABILITY TO TASK	
Setup	Fair
Edutainment	Fair
Productivity	Excellent

MidWest Micro

MidWest Micro P590 Home PC

The \$2,499 MidWest Micro P590 Home PC, positioned as a family computer, offers solid performance and good hardware, including a set of Altec Lansing speakers and a 28.8-/14.4-Kbps fax modem. MidWest Micro does little to help with setup, though, so some familiarity with computers would be best if you're considering this 90-MHz Pentium system.

The system we tested came without a setup guide. It also lacked fully labeled ports: Only the sound card and modem ports were labeled.

MidWest Micro ships the P590 with Microsoft's Bob, which will introduce you to your PC's functions. The unit's other software—which includes Microsoft Encarta 95—should also please. A \$2,399 home-office version of this system comes with Microsoft Office—but without speakers or a sound card.

Audio support was impressive. MidWest Micro included an Aztec Waverider sound card with FM- and wavetable-synthesis capability and a pair of Altec Lansing speakers. The combination fared well on our subjective sound tests. On our benchmark tests, the system was an average performer in its 90-MHz group.

The unit has a three-year warranty; no on-site service is available.—**WPF**

MidWest Micro, Fletcher, OH; 800-871-9127, 513-368-2309; fax, 800-562-6622; mwmicro.com.

Circle 475 on reader service card

SUITABILITY TO TASK	
Setup	Excellent
Edutainment	Good
Productivity	Good

SERVICE & RELIABILITY

MidWest Micro	
Reliability	Better than average
Repair	Average
Technical support	Average
Percent needing repair	Average



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Canon

Multiwave Technology Inc.

SOHO MPEG System

Aimed at the home-office market, the \$1,995 SOHO MPEG System was an intriguing mix of high-end and bargain-basement hardware. The result was a Pentium/100-based mid-tower that fell just short of its promise as a complete multimedia PC with full MPEG support.

Multiwave Technology made an attempt to assist novices. Rear ports were labeled, and the floppy disk and CD-ROM drives were marked with their assigned drive letters. But only brief, one-page setup and troubleshooting guides were included.

A key feature of this PC was its MPEG video decoder: a DCS Avant-Courier MPEG board. When combined with Acer Sertek's MPEG software (which had a friendly remote-control-like interface), the unit offered flicker-free, full-screen playback. Unfortunately, the unpowered Creative Labs speakers sounded weak even with software volume controls turned up.

The SOHO MPEG System included a Creative Labs Phone Blaster 14.4-Kbps data/fax/voice modem and sound board. Software included Microsoft Encarta 95 and Microsoft Works, as well as an MPEG version of *Addams Family Values*.

The system posted below-average Winstone 96 and Disk WinMark 96 scores for its CPU class—likely due to

SUITABILITY TO TASK	
Setup	Fair
Edutainment	Good
Productivity	Good



its budget-oriented Conner hard disk. Its Graphics WinMark 96 score was average.

The system has a one-year warranty. One year's on-site service costs \$30.—**RSA Multiwave Technology Inc., City of Industry, CA; 800-234-3358, 818-330-7030; fax, 818-333-4609.**

Circle 476 on reader service card

NEC Technologies

Ready 9022

The \$2,099 Ready 9022, from NEC Technologies, is intended as a general-purpose home PC. The Pentium/100 system is very easy to set up, but mixed results in all areas of testing suggest that this PC misses its mark.

System setup is aided by a poster and color-coded cables. The unit's most distinguishing feature, however, is its remote control, which runs the CD-ROM drive and the answering and dialing functions of the PC's telephony software

SUITABILITY TO TASK	
Setup	Good
Edutainment	Fair
Productivity	Excellent

SERVICE & RELIABILITY

NEC Technologies

Reliability	Average
Repair	Average
Technical support	Average
Percent needing repair	Better than average



through an infrared port. A 28.8-Kbps modem and educational, productivity, and reference software packages are also included.

In software-compatibility testing, Doom ran with music but without sound effects; and Magic School Bus wouldn't run in full-screen-animation mode. (These minor problems could likely have been fixed with calls to tech support.) The 7-watt-per-channel MLI-691H speakers weren't a great choice, however, producing tinny sound.

Benchmark test scores were all below average for the PC's CPU group. In video testing, the system's maximum frame rate was low, and it dropped a significant number of frames on some tests. There was noticeable jumpiness on the subjective, full-screen video-clip test.

NEC provides a three-year warranty, with one year of on-site service.—**BB NEC Technologies, Boxborough, MA; 800-632-4636, 508-264-8000; fax, 508-264-8673; www.nec.com.**

Circle 477 on reader service card

NETis Technology Inc.

NETis N575 Media

The \$2,095 NETis 575 Media PC, from NETis Technology, offers better-than-average hard disk performance for a 75-MHz Pentium PC but is light on the documentation and user assistance necessary to make it a true home system. The unit is positioned as an edutainment PC and has some software to back that up.

The N575 Media doesn't offer much assistance for novice PC users. Although ports were labeled, there was no general system manual or setup guide.

The unit does offer business-level telephony features with a 14.4-Kbps data/fax/voice modem and Cheyenne Software's BitWare Lite 3.22 all-in-one communications package. Also included is an ATI Graphics WinTurbo 64-bit graphics board, a 1.6GB hard disk, and a Creative Labs Vibra 16 sound board.

A 15-inch Proton monitor features a volume control, headphone jack, and adjustable glare shade, as well as two built-in speakers. Bundled software consisted of several Microsoft CD-ROM titles, including Ancient Lands, Encarta 95, and Works.

The PC was an average performer for its class on our Winstone 96 and CD-ROM WinMark 96 tests. It posted above-average scores on our Disk WinMark 96 and Graphics WinMark 96 tests, and performed well on our subjective video tests.

NETis provides a warranty that covers parts for one year and labor for three; on-site service is free the first year.—**RSA NETis Technology Inc., Milpitas, CA; 800-577-7526, 408-263-0368; fax, 408-263-4624; www.netis-tech.com.**

Circle 478 on reader service card

SUITABILITY TO TASK	
Setup	Fair
Edutainment	Good
Productivity	Good



Packard Bell Electronics Inc.

Packard Bell Pentium 100 Designer Tower

The \$2,849 Packard Bell Pentium 100 Designer Tower is geared for all family members, bundling both entertainment and home-office applications. This PC wasn't a good performer on our benchmark tests, but few vendors can beat Packard Bell at designing home PCs. The company also sells the "Corner Computer," a triangular-shaped PC designed to fit into a corner.

The Designer Tower is easy to set up. A setup poster will help you assemble the unit, and Navigator, the vendor's Windows front end, will guide you through system features and functions. There's also an infrared remote control for operating the CD-ROM drive and making phone calls using the unit's internal 14.4-Kbps fax modem. The 15-inch monitor has speakers on each side, but they provide mediocre mid- and high-range response.

Lacking L2 cache, the Designer Tower turned in low Windows-based test scores.

It did perform well in video-clip testing, however, with only minor frame dropping in the full-screen scale test.

In software-compatibility testing, when we installed Myst, a driver conflict caused the CD-ROM drive to hang until Windows was restarted. The unit supports software-based MPEG, and

SUITABILITY TO TASK	
Setup	Excellent
Edutainment	Good
Productivity	Excellent

SERVICE & RELIABILITY

Packard Bell Electronics Inc.

Reliability	Average
Repair	Worse than average
Technical support	Worse than average
Percent needing repair	Better than average



ships with Silent Steel, a full-motion video game.

The Designer Tower is backed by a one-year, on-site warranty.—*BB*
Packard Bell Electronics, Inc., Sacramento, CA; 800-733-5858; www.packardbell.com.

Circle 479 on reader service card

PerComp Microsystems Inc.

PerComp P75 MediaPro

The \$2,499 PerComp P75 MediaPro desktop, from PerComp Microsystems, offers average performance, and its wireless accessories and entertainment software bundle make it a downright fun machine to use.

While the MediaPro lacked a general system manual, all component documentation, warranty cards, and even loose floppy disks were carefully organized in three-ring binders. All rear ports were labeled.

One of the system's highlights was its AI Tech Wireless Bandit, a wireless game-controller system. Once the infrared receptor was plugged into the sound card's game port, the two wireless controllers

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SUITABILITY TO TASK

Setup	Good
Education	Good
Productivity	Good

worked flawlessly when tested with games such as Doom.

Also included with the unit was a 40-CD case. The system's software bundle included Microsoft Encarta 95 and PerComp's Top 10 CD-ROMs.

All data, fax, voice mail and audio functions were handled by a Creative Labs Phone Blaster, which incorporates a 14.4-Kbps voice modem and an FM-synthesis audio system on one card. Our informal panel of sound testers judged the audio system—which used powered MLi

95 speakers—to be good.

The MediaPro's Winstone 96 score was average for its CPU class, while its Graphics WinMark 96 score was above average. The machine's Disk WinMark 96 score was below average, however, due to its budget-oriented Conner hard disk.

The unit comes with a one-year warranty that includes a year of free on-site service. Technical support is available 24 hours, 7 days.—*RSA*

PerComp Microsystems Inc., Richardson, TX; 800-856-6688, 214-234-2198; fax, 214-234-8658; GO PCMI on CompuServe.

Circle 480 on reader service card

Polywell Computers Inc.

Poly 500P8

The \$2,499 Poly 500P8, from Polywell Computers, offers solid hard disk and CD-ROM performance at a competitive price. However, the system offers virtually no assistance for novice users, providing only a general system manual.

The Pentium/100-based mini-tower had a Microsoft-like, one-piece ergonomic keyboard. The system also shipped with a Creative Labs Vibra 16 sound card, a Diamond Stealth Video DRAM graphics card, and a 14.4/9.6-Kbps data/fax modem.

Rounding out the hardware was a pair of Yamaha YST-M5 speakers; our informal panel of sound testers gave the audio setup an average score. A software bundle consisted of a handful of Microsoft titles, including Works 3.0 and Money 3.0.

SUITABILITY TO TASK

Setup	Fair
Education	Good
Productivity	Good



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The Poly 500P8 yielded an average score for its CPU class on our Graphics WinMark 96 tests. Aided by its Quantum Fireball hard disk, the unit garnered an above-average Disk WinMark 96 score, which helped it post a Winstone 96 score that also was above average. The PC's CD-ROM WinMark 96 score was the highest in this roundup.

The Poly 500P8 comes with a warranty that covers parts for three years, and labor for five. On-site service is \$75 for the first year.—RSA

Polywell Computers Inc., S. San Francisco, CA; 800-999-1278, 415-583-7222; fax, 415-583-1974.

Circle 481 on reader service card

Quantex Microsystems Inc.

Quantex QP5/100 M-4

With solid performance and lots of home-oriented software, the \$2,299 Quantex QP5/100 M-4 stands out as a well-stocked home PC. Quantex positions the machine as a family and home-office system.

Documentation for the Pentium/100-based mini-tower included a useful quick-setup guide, a list of support phone numbers, and a warranty and support booklet. The system manual offered adequate illustrations to guide new users.

The PC also came with a pair of Altec Lansing ACS5 speakers and an Ensoniq

SUITABILITY TO TASK	
Setup	Good
Edutainment	Excellent
Productivity	Good

SoundScape wave-table sound board.

Winstone 96 and Graphics WinMark 96



scores were both above average for the unit's CPU class, while its Disk WinMark 96 score was average. The system had no problems with our software-compatibility tests.

The system came with a 14.4-Kbps

fax/voice modem as well as software for voice mail and fax functions. Quantex also bundled other useful titles with the unit, including Random House Webster's School and Office Dictionary and Compton's Interactive Encyclopedia.

Quantex backs the system with a one-year on-site warranty.—RSA

Quantex Microsystems Inc., Somerset, NJ; 800-613-2047, 908-563-4166; fax, 908-563-0407; www.quantex.com.

Circle 482 on reader service card

Robotech Inc.

Cobra XLT75 Home Office

Robotech's \$2,499 Cobra XLT75 Home Office comes with an attractive bundle of software and offers adequate performance, but its graphics system left something to be desired. The company positions the 75-MHz Pentium sys-

SUITABILITY TO TASK	
Setup	Good
Edutainment	Good
Productivity	Good



tem mainly as a home-office machine, and also targets family users.

Though component manuals were included, there was no documentation to assist novices.

The unit came with a pair of Creative Labs Sound Blaster powered speakers. Our informal group of audio testers gave the XLT75's audio setup a low grade. The system also included a 14.4-Kbps voice modem and FaxWorks software.

Robotech's software bundle included Novell PerfectOffice, a battery of Microsoft titles, and Quicken Deluxe. A six-outlet surge suppressor was also provided.

The unit yielded average Winstone 96 and Disk WinMark 96 scores. However, it produced the lowest Graphics WinMark 96 score in its CPU class—a performance attributable to the Number Nine 9FX Vi-

sion graphics board with 1MB of DRAM.

Robotech backs its PC with a two-year parts and lifetime labor warranty; on-site service is included for one year.—RSA

Robotech Inc., Midvale, UT; 800-533-0633, 801-565-0645; fax, 801-565-0680; robotech@xmission.com.

Circle 483 on reader service card

Treasure Chest Computers

Treasure Chest TCP575

Useful telephony features and software make the \$2,295 Treasure Chest TCP575 a good choice for the home office. Its benchmark test scores, which were some of the best in its CPU class, sweeten the deal.

The 75-MHz mini-tower offers a number of extras for novices, including an installation video, a short but adequate manual, and a sheet of support numbers for dozens of hardware manufacturers.

The system comes with SuperVoice 2.0, which allows users to access data, fax, and voice mail functions from a single interface. Other titles include Novell PerfectWorks and Compton's Interactive Encyclopedia.

On our benchmark tests, the TCP575 yielded the best Winstone 96 and Graphics WinMark 96 scores in its CPU class and an above-average Disk WinMark 96 score. Its CD-ROM WinMark 96 score was the lowest in its class, however.

The system had no problems with our software-compatibility tests and turned in fairly smooth video performance. The audio system, which consisted of a Creative Labs Sound Blaster 16 sound board and a set of Altec Lansing speakers with a subwoofer, did well in our informal sound tests.

The unit has a two-year warranty;

SUITABILITY TO TASK	
Setup	Fair
Edutainment	Good
Productivity	Fair



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Circle 484 on reader service card

Tri-Star Computer Corp.

Tri-CAD Multimedia

The \$2,495 Tri-CAD Multimedia, from Tri-Star Computer Corp., combines stellar performance with good user assistance and interesting software. While the company has traditionally focused on CAD/CAM and high-end graphics users, it targets this system at serious home users.

Tri-Star includes an illustrated user manual and a Read Me First sheet; additional sheets provide warranty and technical support information.

The Tri-CAD Multimedia was configured with a 14.4-Kbps fax modem and a 16-bit FM-synthesis sound board. The MLI-691H powered speakers, however, were rated below average by our listener panel. Bundled software included MegaConnect Lite communications software, Netcom's NetCruiser, and some Microsoft CD-ROM titles.

Within its class, the Tri-CAD was a top performer on our Winstone 96 and Graphics WinMark 96 tests. While its Disk WinMark 96 score was average, its CD-ROM

SUITABILITY TO TASK	
Setup	Good
Edutainment	Fair
Productivity	Good

SERVICE & RELIABILITY

Tri-Star Computer Corp.

Reliability	Average
Repair	Average
Technical support	Average
Percent needing repair	Average



On-site service for a year is \$49.—**RSA Tri-Star Computer Corp., Tempe, AZ**; 800-473-6223, 602-731-4926; fax, 602-731-4979; www.tri-cad.com.
Circle 485 on reader service card

USA Flex Inc.

Flex PT-90 Home Multimedia System

The 90-MHz \$2,399 Flex PT-90 Home Multimedia System, from USA Flex, is set apart by its software bundle and accessories, making it a truly ready-to-use home PC. It also offers average performance across the board.

The mini-tower system was packaged with the novice user in mind. A quick-setup poster and a video are provided to guide new users through their first few hours with the machine.

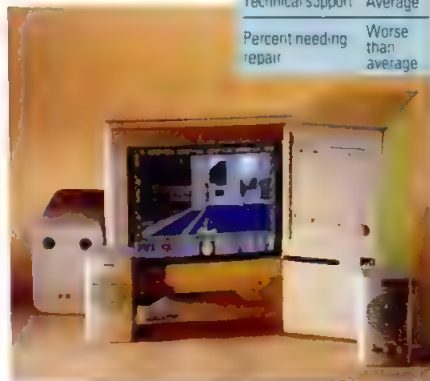
The Flex PT-90 bundles a Turtle Beach MonteCarlo 16-bit FM-synthesis sound card and a set of Altec Lansing

SUITABILITY TO TASK	
Setup	Excellent
Edutainment	Good
Productivity	Good

SERVICE & RELIABILITY

USA Flex Inc.

Reliability	Average
Repair	Average
Technical support	Average
Percent needing repair	Worse than average

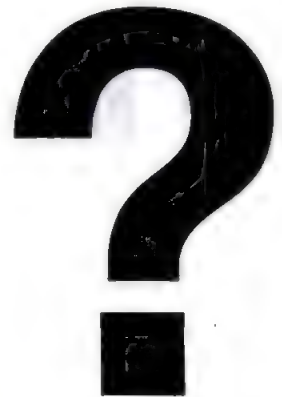


ACS31 speakers with a large subwoofer. The result is one of the best-sounding systems in our roundup. Voice mail features are provided through a 14.4-Kbps fax/voice modem.

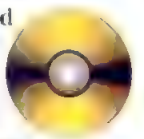
The system's software bundle consisted mainly of entertainment and education titles, including Grolier's Multimedia Encyclopedia 1995, Mindscape's World Atlas 5, and Softkey's One-Stop CD Shop.

The Flex PT-90 also came with lots of extras, including two books: *Internet for Dummies* and *Internet Yellow Pages*. A joystick and a computer accessories kit (consisting of a surge protector, a tool kit, and a parallel cable) were also included.

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The PC comes with a three-year parts, lifetime labor warranty; one-year of on-site service is included. Toll-free support is available 24 hours, 7 days.—RSA
USA Flex Inc., Bloomington, IL; 800-872-3539, 708-582-6202; fax, 708-351-7204.
Circle 486 on reader service card

Vektron

Multimedia Home

Although Vektron's \$2,569 Multimedia Home PC provides the level of performance and hardware needed in a home PC, the Pentium/100-based unit doesn't come with the documentation or on-line help that novices might need. That's unfortunate, as the unit is targeted toward families and multimedia users.

The unit was set up with a Creative Labs Sound Blaster AWE32 wavetable sound board and Yamaha YST-M5 speakers—an adequate setup according to



SUITABILITY TO TASK

Setup	Fair
Edutainment	Good
Productivity	Excellent

our panel of listeners. The system also came with a 28.8-/14.4-Kbps fax modem and a sextuple-speed CD-ROM drive.

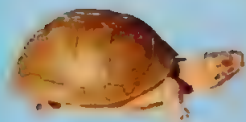
The Multimedia Home PC posted above-average Winstone 96 and Graphics WinMark 96 scores for its CPU class. Its Disk WinMark 96 score was average.

We received two software bundles with the system, one that included Compton's Interactive Encyclopedia and another that consisted of a handful of Microsoft titles. (The second bundle is \$99; we included it in the price above.)

Vektron backs its PC with a one-year parts and lifetime labor warranty.—RSA

Vektron, Grand Prairie, TX; 800-725-0009, 214-606-0280; fax, 214-606-1278; www.vektron.com.

Circle 487 on reader service card



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FAST ETHERNET ADAPTERS

Shifting into High Gear

If your Ethernet LAN is starting to feel like the freeway during rush hour, it's time to consider the new 10/100 Fast Ethernet cards.

By John Garriss



Most computer users remember 1995 as the year of the Internet or Windows 95, but those in the networking world will probably think of a third, equally revolutionary trend. For them, 1995 will be the year of Fast Ethernet.

While standard Ethernet has been the norm for installing local area networks (or LANs) for more than a decade, its 10-megabit-per-second (Mbps) bandwidth limitation is finally starting to show its age. Ethernet was certainly capable of handling simple file transfers among 286 and 386 PCs, but today's Pentium and PowerPC computers are designed to handle more complicated bandwidth-intensive applications. With client/server databases and collaborative applications like Lotus Notes becoming more popular, and with networked multimedia and videoconferencing on the horizon, even small Ethernet networks will soon slow to a crawl.

Fast Ethernet, which runs at a healthy 100 Mbps, is certainly up to the task. After years of discussion, the Fast Ethernet standard has now been finalized, and most of the networking community has embraced the new technology. And the cost of implementing Fast Ethernet may be a lot less than you think: In the not-too-

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Fast Ethernet Adapters

distant past, high-speed LAN adapter cards cost \$1,500 or more, but we found Fast Ethernet cards with street prices as low as \$135, making them very cost-competitive with regular Ethernet adapters.

FOCUS ON THE WORKGROUP

In this roundup we've gathered the current crop of Fast Ethernet network adapters on the market. These are often called *10/100* adapters because they can work on both standard 10-Mbps Ethernet networks and 100-Mbps Fast Ethernet networks. 10/100 operation makes these adapters ideal for companies that are thinking about Fast Ethernet for the near future but can't afford to displace their installed base of Ethernet hubs and switches today. You can buy 10/100 adapters now for your existing networks, then upgrade the other devices later to reap the full benefits.

We reviewed both server and client adapters. For the server, we tested both PCI and EISA bus implementations, while for the clients we tested the PCI versions only. We don't generally recommend ISA-bus adapters for high-speed networking because of the throughput limitations of the ISA bus. We tested EISA adapters for the server since much of the installed base of server PCs is still based on the EISA bus. However, all three of the EISA server adapters we re-

viewed showed unacceptably high CPU utilization in our tests. We recommend PCI adapters whenever possible.

We also limited our roundup to products based on the 100Base-TX Fast Ethernet specification. Fast Ethernet, also known as 100Base-T, actually comprises

We don't generally recommend ISA-bus adapters for high-speed networking because of the throughput limitations of the ISA bus.

three separate specifications that describe different physical-layer transmission schemes for Fast Ethernet. Of the three, by far the most popular is 100Base-TX, which runs over two pairs of copper wire known as Category 5 unshielded twisted-pair (UTP), or over Type 1 shielded twisted pair (STP). Another specification, 100Base-FX, calls for more expensive fiber-optic cable; there are a few 100Base-FX products now available that are de-

signed primarily for backbone installations. The third specification, 100Base-T4, runs over Category 3, 4, or 5 copper wire; there were no T4 hubs available for our review, but the first ones should be available by the time you read this.

HIGH-SPEED CHOICES

In the crowded market for high-speed networking products, Fast Ethernet isn't the only technology you'll need to consider. A competing technology called 100VG-AnyLAN, for example, is also engineered for 100-Mbps operation, and a number of companies are now shipping both 100VG-AnyLAN adapters and repeaters at prices very competitive with Fast Ethernet products. Unlike Fast Ethernet, which uses the same collision-based CSMA/CD (Carrier Sense Multiple Access with Collision Detection) architecture as regular Ethernet, 100VG-AnyLAN employs Demand Priority Architecture (DPA) to transmit network information. DPA avoids collisions and is in many ways technically superior to Fast Ethernet. 100VG-AnyLAN's biggest drawback is lack of support from some of the major networking vendors (for more on 100VG-AnyLAN, see the sidebar "The Other 100-Megabit Solution").

Asynchronous transfer mode (ATM) has been hyped for years as the foundation for the next generation of networking

Seven Upgrades From 10Base-T

	Switched Ethernet workgroups with 10-Mbps Ethernet to the server	Switched Ethernet to each client and to the server	Switched Ethernet to each client with Fast Ethernet to the server	Shared Fast Ethernet to each client and to the server
Pros	Reduces congestion without the need to change client adapters.	Each client has dedicated 10-Mbps bandwidth.	Each client system has dedicated 10-Mbps bandwidth. A high-use server has a high-speed connection.	Client systems and server share 10 times the bandwidth of Ethernet.
Cons	Potential bottleneck at server. Clients must share 10 Mbps with others in the workgroup.	Connecting switches can create a bottleneck.	Connecting switches can create a bottleneck. Users must replace server adapters.	Requires Category 5 UTP cable today. (Category 3 products are on the way.) Users must replace all adapters and reconfigure hubs.
Client and server computer requirements	No need to upgrade existing client and server PCs.	No need to upgrade existing client and server PCs.	Server needs a new Fast Ethernet adapter and PCI or EISA bus.	All clients and servers need new Fast Ethernet adapters. Each client or server should be a Pentium system with a PCI bus.
Cabling requirements	Category 3 UTP or higher.	Category 3 UTP or higher.	Category 3 UTP or higher for clients; Category 5 UTP to the server.	Category 5 UTP.
Estimated upgrade cost*	\$1,200	\$6,600	\$7,950	\$10,450

* Prices are based on an upgrade from a shared 10Base-T LAN with 2 servers and 20 clients.

Estimated component prices: Switched Ethernet port, \$300; high-speed port module on Ethernet switch, \$800; Fast Ethernet 10/100 adapter, \$175; Fast Ethernet repeater port, \$300; Fast Ethernet switched port, \$800; ATM25 (25.6-Mbps)

Intel EtherExpress PRO/100B

Fast Ethernet Adapters are rapidly coming down in price, but some are better performers than others. Many products performed well as client solutions but

as server adapters they proved to be resource hogs.

The Intel EtherExpress PRO/100B earns our Editors' Choice for its unmatched all-around performance, advanced features, and low price. At a \$149 street price, one of the lowest in our roundup, the PRO/100B topped most of our benchmark tests. As a server adapter it returned the best Performance/Efficiency Index score, and the highest throughput rate.



It was also the second-fastest client adapter we tested. Besides outstanding price and performance, the PRO/100B

conforms to the Fast Ethernet auto-negotiation standard—one of just three cards reviewed to include this feature.

The 3Com Fast EtherLink 10/100 PCI, close behind the Intel PRO/100B, receives an honorable mention. It had the best throughput on the client version of our NIC Throughput test for the lowest

price (\$135 street). However, it had average server throughput performance and midrange server CPU utilization.

The Digital Fast EtherWorks PCI 10/100, with its Parallel Cut-Through Technology, also placed among the better performers of cards we reviewed. Two other PCI cards, the Cogent EM110TX and the SMC EtherPower 10/100, showed good performance as both client and server adapters.

Two cards in our roundup are specifically targeted as server NICs. The Intel PRO/100 Smart adapter achieved extremely low CPU utilization with very good server throughput. The Cogent EM 400TX includes four 100-Mbps ports, and while its throughput was average, its overall efficiency was better than most other cards.

services. Its built-in provisions to handle multiple data types (including audio and video), as well as specifications to run at 155 Mbps and higher, make it a technology with a promising future. Right now, however, few products are shipping, standards have not been finalized, and implementation costs are still fairly high.

In response to the high costs of ATM, a consortium of vendors called the Desktop ATM25 Alliance is pushing a new

workgroup ATM specification that runs at 25.6 Mbps. With adapter prices going at about \$400, 25-Mbps ATM may become a viable workgroup solution as the industry waits for higher-speed ATM solutions to come down in price. Unlike Fast Ethernet and 100VG-AnyLAN, however, these ATM adapters don't have any provisions for backward-compatibility with 10-Mbps Ethernet (for more on ATM, see the sidebar "Workgroup

ATM: Tomorrow's Technology Today").

If your network is congested, remember that you can often increase your available bandwidth without ever replacing your existing network adapters. By simply replacing an Ethernet hub with a device called an Ethernet switch, you can provide 10 Mbps of dedicated bandwidth to each port of your switch, and you can keep all of your existing LAN adapters and cabling. You can also buy switches that offer high-speed ports to handle your server connections (for more on switching, see the sidebar "Get in Line for the Technology").

Switched Fast Ethernet to each client and to the server

Each client system has dedicated 100-Mbps bandwidth.

Expensive. Few Fast Ethernet switches are available. Requires Category 5 UTP cable today. (Category 3 products are on the way.)

All clients and servers need Fast Ethernet adapters. Each client or server should be a Pentium system with a PCI bus.

Category 5 UTP.

\$21,450

ATM25 (25.6 Mbps) to each client with ATM SONET (155 Mbps) to the server

Clients get switched ATM over Category 3 cable.

Few client OSs are now supported (such as Windows NT). Few compatible applications. Clients are limited to 25 Mbps. Expensive.

Clients need new ATM25 adapters. Server needs an ATM SONET adapter. The server must be a Pentium system with a PCI bus.

Category 3 UTP or higher for clients; Category 5 UTP or fiber for server.

\$38,400

ATM SONET (155 Mbps) to each client and to the server

The ultimate in high-speed ATM switched networks.

Few client OSs are now supported (such as Windows NT). Few compatible applications are available. Expensive.

All clients and servers need new ATM SONET adapters. Each client or server should be a Pentium system with a PCI bus.

Category 5 UTP or fiber.

\$48,400

WHAT WE FOUND

With two exceptions, all of the products in this review are designed to perform both as a client and server adapter; the only difference between the two functions is the driver you use for the operating system you have. Most of the adapters come with Open Device Interface (ODI) and Network Driver Interface Specification (NDIS) drivers, which assure compatibility with a number of client and server operating systems. All of the products here have DOS/Windows and NetWare 3.x/4.x drivers, and most have drivers for Windows NT and OS/2 as well. And two of the 20 adapters—from Asanté and Rockwell Network Systems—include Macintosh drivers for PowerPC-based Macintoshes with PCI slots.

When we ran our benchmark tests, we considered CPU utilization on the server

adapter, \$700; ATM SONET (155-Mbps) adapter, \$1,200; ATM25 port, \$1,000; ATM SONET port, \$1,000.

HIGHLIGHTS

Fast Ethernet Adapters

When calm streams of LAN traffic grow into raging currents, you will need to speed the network or risk turning your server into the Hoover Dam. Enter Fast Ethernet, the 100-Mbps networking standard that's designed to handle bandwidth-greedy client/server databases, multimedia applications, and videoconferencing. These 10/100 adapters are ideal for laying the pipe for Fast Ethernet in the future but keeping your installed base of cabling and Ethernet hubs and switches intact for now.

PRICES of Fast Ethernet adapters have dropped rapidly. High-speed adapters once cost \$1,500 or more, but most of the 10- and 100-Mbps Fast Ethernet cards in our roundup had street prices under \$200 and as low as \$135, making them cost-competitive

just as important as peak throughput rates. If a server adapter card hogs all the CPU cycles performing network transfers, then it will bring down overall server performance. In general, we found that PCI-based adapters did a better job than their EISA-based counterparts at keeping down CPU utilization on the server. The lowest utilization scores came from the Cogent EM 110TX (23 percent) and from the Intel EtherExpress PRO/100B (24 percent) and EtherExpress PRO/100 Smart (25 percent), the latter of which is targeted directly at the server market. Nine of the adapters showed a CPU utilization above 90 percent when tested with 8 clients. The worst were two of the three EISA adapters, the SMC Ether 10/100 and 3Com Fast EtherLink EISA, both of which had 100 percent CPU utilization. Of the PCI adapters, the BocaLAN-card and the D-Link ProFast came in last, with CPU utilization of 99.9 percent. Measured in raw throughput, the Intel PRO/100 B was the best server performer, peaking at 91.7 Mbps on the server version of our NIC Throughput test with 32K blocks. On the client side, the 3Com Fast Etherlink PCI 10/100 came out on top, hitting over 80 Mbps on our one-to-one client test. The D-Link ProFast DFE-500TX and the Compaq

with regular Ethernet adapters.

THE BUS TYPE of a Fast Ethernet network adapter will most likely be PCI, which is better suited for high-speed data transmission than EISA, ISA, or MCA buses. Most of the cards we tested were PCI-based, but we tested both PCI and EISA bus implementations on our server test runs because of the large base of EISA-based servers. But the EISA adapters showed poor CPU utilization results, and we recommend using PCI cards if possible.

AUTO-SENSING drivers, found in 11 of the products, can make your upgrade significantly easier by detecting installed 100-Mbps repeaters and automatically resetting the adapter from 10 to 100 Mbps. Two other

NetFlex-3/P had the worst throughput, at 44 Mbps.

Performance is an often-hyped feature of network adapters, but minor performance differences among the top cards may not mean very much in the long run. Instead, you should look at other features that can significantly enhance ease of use. For example, we looked for cards with single connectors that auto-sense 10-Mbps or 100-Mbps operation. Less desirable adapters come with two separate connectors for 10-Mbps and 100-Mbps operation—with those you'll have to go to each machine to switch connectors when you want to upgrade. Of the 20 adapters we tested, 11 had one auto-sensing connector, which is implemented via the driver software. In addition, the AsantéFast 10/100 PCI, Intel EtherExpress, and Znyx ZX342 featured *auto-negotiation*, which is a recent addition to the IEEE 802.3

adapters from Asanté, Intel, and Znyx feature auto-negotiation, a new hardware-based part of the 802.3 spec that lets two devices determine the fastest speed available to both.

OTHER FAST NETWORKING technologies besides Fast Ethernet include 100VG-AnyLAN, a competing standard also designed for 100-Mbps operation. 100VG is in some ways technically superior to Fast Ethernet. However, 100VG-AnyLAN does not have support from as many networking vendors as Fast Ethernet. Considered to be the fast-networking standard of the future, asynchronous transfer mode (ATM) has been under development for years. Workgroup ATM solutions exist today but they are expensive and standards are still very much in development.

standard and detects 10- or 100-Mbps operation, as well as half- or full-duplex operation (allowing 20- or 200-Mbps bi-directional transmission between nodes), in hardware. Expect more adapters featuring auto-negotiation in the near future.

In addition, we looked for clear, well-documented installation programs, as well as Windows 95 and Plug and Play compatibility. Better adapters also came with several LED indicators to indicate network status.

Finally, you'll need to look at price. We found PCI adapters generally less expensive than their EISA counterparts—the 3Com Fast EtherLink, for example, lists at \$159 for PCI but \$285 for the EISA version. Although prices are already low, we expect even further drops as Fast Ethernet becomes more popular over the next year. The 3Com Fast EtherLink 10/100 PCI came in with the lowest list price at \$159 per adapter (\$135 street price), and

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Fast Ethernet Adapters

we expect the other vendors to initiate similar price drops in coming months.

BUYER BEWARE

Perhaps the most important consideration when building a next-generation network is cabling. Many older buildings are wired with older Category 3 UTP cable, which won't work with the 100Base-TX products reviewed here. If your building has older cabling, you'll either have to upgrade to Category 5 UTP or wait for 100Base-T4 products to come, which work with Category 3 UTP.

Also, remember that the rules used for standard Ethernet networks don't always apply with Fast Ethernet. In particular, the distance limitations and rules for cascading hubs are much more restrictive: You can cascade only two hubs together with a maximum distance of 205 meters between your end-nodes, compared with four hubs and 2,500 meters for regular Ethernet. If you need more flexibility with your cabling, you may want to consider either the 100VG-AnyLAN specifications or products based on fiber-based 100Base-FX Fast Ethernet (see "Cascades of hubs" on the right).

Finally, although Fast Ethernet is similar to standard Ethernet, they're not the same thing, so you'll need to find a way of connecting your Fast Ethernet workgroups to the rest of your networking infrastructure. The easiest way to do that is to use a hub bridge module, which handles all the translations required between your existing Ethernet and Fast Ethernet segments. Many vendors currently offer bridge modules or will in the near future.

THE TIME IS NOW

Fast Ethernet is finally here, and it's going to stay for quite a while. So the next time you order your super-fast Pentium PCs with blazing video and gigabytes of hard disk space, think twice before you put a regular Ethernet card inside. Think 10/100, and plan for the future.

Accton Technology Corp.

Accton EtherFast-TX PCI

With a street price of \$199, the Accton EtherFast-TX PCI includes a wide array of drivers and both RJ-45 and BNC connectors. We would not recommend it as a server NIC because of its low

Performance/Efficiency Index score. As a client NIC, the EtherFast-TX had mixed results, with top scores on some test runs and below-average scores on others. The card does not include an installation utility and cannot auto-sense line speed.

The EtherFast-TX placed third on the client version of our NIC Throughput test but most of its other scores were below average. The card uses a speed-enhancement technology called PCIMLID, which supposedly increases throughput by sending data directly to the PC bus, bypassing the processor's internal buffer whenever

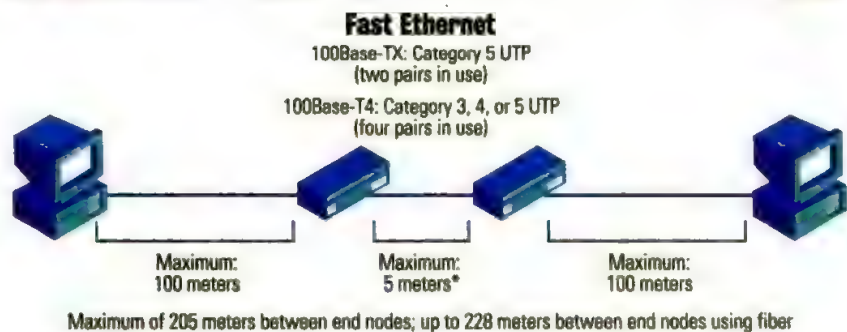
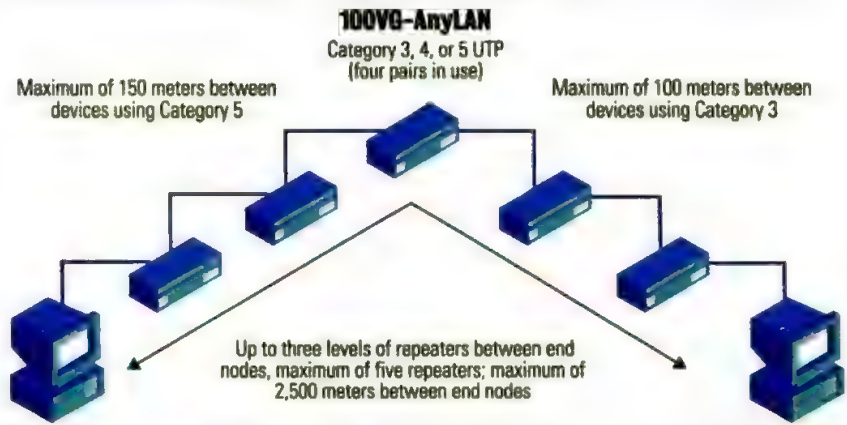
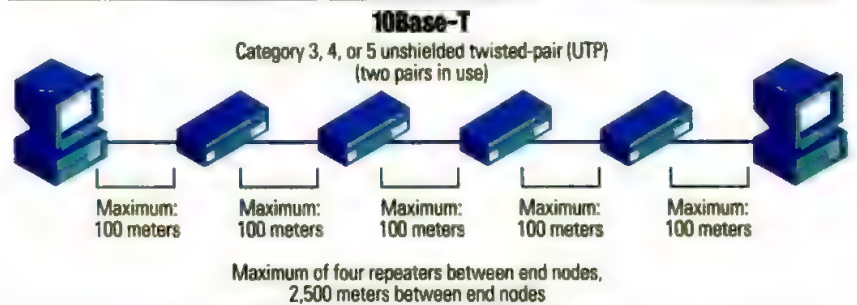
possible. The EtherFast-TX also is capable of full-duplex performance at 10- and 100-Mbps speeds.

Unlike most adapters we looked at, the EtherFast-TX has both Thin Ethernet and UTP connectors. One of the card's RJ-45 connectors and its BNC connector work at 10 Mbps, the other RJ-45 at 100 Mbps. The card cannot auto-sense line speed, so you must switch jacks when upgrading to 100 Mbps but you do not need to change the client software configuration.

An extensive variety of drivers is supplied with the EtherFast TX, including

Cascades of Hubs

Upgrading from 10 Mbps to 100 Mbps may require some recabling and reconfiguration of your LAN. Below are some cabling standards for 10Base-T, 100Base-T, and 100VG-AnyLAN to help you determine your easiest upgrade path. Remember, switching or stackable hubs can be used to get around repeater rules.



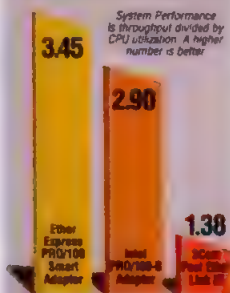
* The distance between repeaters can be greater than 5 meters as long as the 205-meter limit is observed



Intel's powerful Fast Ethernet

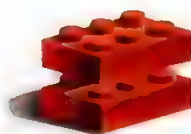
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—of—
YOUR NETWORK

Performance/Efficiency Index*



*SOURCE: LANQuest Labs, September 1995

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Consider the Alternatives

By Frank J. Derfler, Jr.

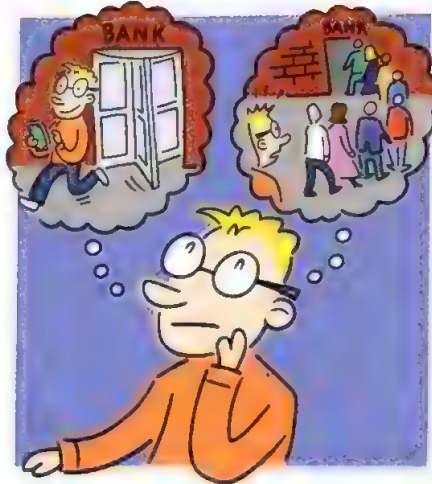
Getting clogged up? Think you need faster networking? Alternatives such as switching, isochronous Ethernet, full-duplex Ethernet, 100VG-Any-LAN, and ATM compete with Fast Ethernet in specific niches, but when and where?

Let's compare your crowded LAN to a bank plagued by long lines. Installing an Ethernet switch on your existing 10-Mbps network is like giving each customer a private teller window. Behind the counter, a single teller on roller skates moves so fast that no client has waiting time to start a transaction. Similarly, with an Ethernet switch, each client gets instant access to the LAN.

Installing the Fast Ethernet (100Base-T) or 100VG signaling system is analogous to keeping a single teller window while teaching the teller and customers to talk and move in fast-forward. There is less waiting with fast signaling because data is moving through the pipe so quickly. 100VG also allows data with special needs, such as video, to get priority, similar to letting people with special needs go to the head of the line.

Isochronous Ethernet and full-duplex Ethernet systems, while different from each other in design, are like servicing the line with two windows—one for withdrawals and one for deposits. Each client is supposed to do more than one thing at a time but at regular speed, therefore reducing waiting and improving efficiency.

ATM breaks up your data into a series of small cells, but some clients can send more cells per second than others. In our analogy, ATM becomes a ballet of clients in the bank lobby, with each client making transactions in a series of tiny but fast and carefully orchestrated moves. Each client appears to be constantly moving, but some make more moves per second than others. Alternatively, you could view ATM as a series of very small



armored cars, each car quickly and securely taking a small amount of money to another branch bank. (See the sidebar "Workgroup ATM: Tomorrow's Technology Today.")

PULLING THE SWITCH

So if you have a network with a lot of mixed traffic and clients suffering from delays, then installing a switch is the easiest and most economical thing you can do to improve service to each client. You can install a switch in just a few minutes without changing cabling or opening client PCs. Retail prices run about \$400 per port and street prices are half that.

But remember the teller on roller skates? Installing switching by itself might only move the bottleneck to the server. Combining switching and fast networking allows you to reduce delays and increase the bandwidth. Companies such as Bay Networks, Hewlett-Packard, Kalpana, NBase Switch Communications, Network Peripherals, NetWorth, Optical Data Systems, 3Com Corp., and Wave Switch offer switches with high-speed links to the server to reduce that bottleneck. These companies and others also offer switches with all high-speed ports.

We suggest installing high-speed networking, either 100Base-T or 100VG, if switching with a high-speed link to the server doesn't give the results

you need. Installing high-speed networking throughout the LAN requires a lot more planning than installing switching because it affects every node and the entire LAN cable system. 100Base-T is limited to no more than two hubs per segment and requires high-quality Category 5 cabling. 100VG requires four pairs of wires to each desktop. Installing either system requires a thorough analysis and probably some reconfiguration of the cabling, as well as new adapters and hubs all around. These technologies work best in EISA, PCI, and S-bus computers, so keeping ISA bus PCs on the LAN complicates the configuration of the cabling system.

If your focus is on sending streams of video across the LAN, then your alternatives are isochronous Ethernet (isoEthernet), full-duplex Ethernet, and ATM. IsoEthernet, a technology developed by National Semiconductor Corp., combines ISDN applications like videoconferencing with 10-Mbps networking. The unique isoEthernet signaling scheme adds a 6-Mbps channel, divided into 96 ISDN B-channels, to a standard Ethernet system while keeping the old 10Base-T cabling and configuration. Incite Inc. is pushing the merger of isoEthernet, MPEG video, ISDN, and PBX technologies in its Multimedia Hub and related client products. This technology, which has been a sleeper for years, could be on the upswing with the rise of ISDN.

Full-duplex Ethernet, offered by IBM in its EtherStreamer hub family, rearranges the wires in the 10Base-T cable to give two simultaneous 10-Mbps streams—one outbound and one inbound. Because most LAN traffic moves from the server to the nodes, this technology is probably best used to deliver movies, but that market position is dominated by ATM.

Most of us will start improving our access with switching and then add a fast networking technology, but isoEthernet is interesting because of its ISDN integration.

Benchmark Tests: Fast Ethernet Adapters

What the Numbers Mean

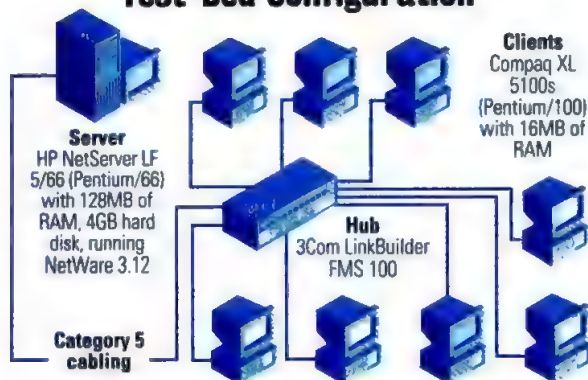
To measure performance for server adapters, we placed an eight-client load on our file server to fill the 100-Mbps Fast Ethernet pipe, ran the server version of our NIC Throughput test, and monitored CPU utilization. Our server adapter benchmark testing resulted in throughputs of more than 91 Mbps for the PRO/100B, followed by a large crop of adapters at around 89 Mbps, with the lowest scores delivered by the Thomas-Conrad TCTX048, AsantéFast 10/100 PCI, Compaq NetFlex-3/E, and SMC Ether 10/100 EISA adapters.

The adapters' network driver implementations account for much of the difference in throughput scores, as adapters with common chip sets and bus types produced widely different results. For example, on the server throughput test the D-Link ProFast DFE-500TX yielded 89 Mbps throughput, and the AsantéFast 10/100 PCI Adapter yielded 69 Mbps, even though both use the same Digital DECchip 21140 chip set. The driver must effectively move data between the adapter hardware and NetWare operating system. Cards with the Digital DECchip 21140 LAN controller dominated our roundup; only Intel and 3Com used their own chip sets, and Compaq used Texas Instruments' ThunderLAN chip set.

THE BETTER BUS

The PCI bus runs at 33 MHz and uses a 32-bit data bus at a peak bandwidth of 132 Mbps—much greater than the bandwidth offered by ISA, EISA, or MCA architectures. PCI adapters, which make up 17 of the 20 in this review, should have returned better performance than any other bus type, but two of the three EISA cards we tested had better results than some PCI cards. The Compaq NetFlex-3/E competed with the upper tier of the PCI adapters and 3Com's Fast

Test-Bed Configuration



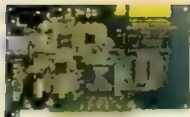
EtherLink EISA bested a number of others, while the SMC EISA was the poorest overall performer.

Speedy throughput, however, is just one part of what to look for in a server adapter. Low CPU utilization is the second part of the equation. Unlike a client adapter that carries out a one-to-one conversation with a server, a server adapter must maintain many client connections at once. In addition, a server's CPU must be free for operations submitted by the operating system—which means you can't afford to have the NIC monopolizing the server processor.

We created our Performance/Efficiency Index to evaluate throughput and CPU utilization, both important performance considerations for server adapters. The PRO/100B again achieved our highest rating, along with the Cogent EM110 TX and Intel PRO/100 Smart adapters. The 3Com and SMC EISA cards showed the lowest scores because of 100 percent CPU utilization during our testing.

	NIC THROUGHPUT— CLIENT (Mbps)		NIC THROUGHPUT— SERVER (Mbps)		CPU UTILIZATION— SERVER (percent)		
	64-byte blocks	1K blocks	64-byte blocks	1K blocks	64-byte blocks	1K blocks	32K blocks
	▲	▲	▲	▲	▼	▼	▼
Accton EtherFast-TX	1.78	17.7	8.99	71.9	96.9	98.0	91.3
AsantéFast 10/100	1.84	19.6	10.14	66.0	94.8	47.4	30.2
BocaLANcard 10/100	1.82	18.0	8.66	68.0	97.0	98.0	98.9
CNet CN100TX	1.81	17.9	9.02	70.6	96.8	98.0	97.1
Cogent EM110 TX Combo	1.80	20.2	9.46	76.5	96.1	54.8	22.8
Cogent EM400 TX PCI Quartet	N/A ¹	N/A ¹	9.14	72.7	96.3	61.8	35.3
Compaq NetFlex-3/P	1.41	14.7	8.53	64.6	63.8	59.5	32.2
Compaq NetFlex-3/E	N/A ²	N/A ²	5.76	54.3	85.8	96.5	96.9
Digital Fast EtherWorks PCI	1.82	20.5	10.09	77.1	95.3	59.6	35.2
D-Link ProFast DFE-500TX	1.81	18.0	8.53	67.0	97.0	98.0	99.9
Intel EtherExpress PRO/100B	1.56	19.1	9.78	75.6	94.2	52.2	24.0
Intel EtherExpress PRO/100 Smart	1.21	13.8	5.32	54.1	35.7	31.2	25.4
Rockwell 2300-TX	1.80	18.0	8.83	69.3	96.9	98.0	98.1
SMC EtherPower PCI 10/100	1.84	20.2	9.74	77.2	95.8	61.7	35.8
SMC Ether EISA 10/100	N/A ²	N/A ²	4.38	37.0	99.0	99.0	100.0
SysKonnect SK-NET Flash 10/100	1.79	17.8	8.41	66.2	97.0	98.0	98.1
Thomas-Conrad TCTX048	1.85	19.6	9.99	66.4	95.4	49.8	30.3
3Com Fast EtherLink PCI	1.68	21.2	7.58	66.0	97.0	86.6	66.8
3Com Fast EtherLink EISA	N/A ²	N/A ²	5.93	50.7	98.0	99.0	100.0
Znyx ZX342 NetBlaster 200	1.74	18.8	9.67	75.2	95.7	61.6	34.0

N/A¹—Not applicable. This product is marketed for server use only. N/A²—Not applicable. We did not test EISA cards in clients.



*The Fast EtherLink 10/100 is available
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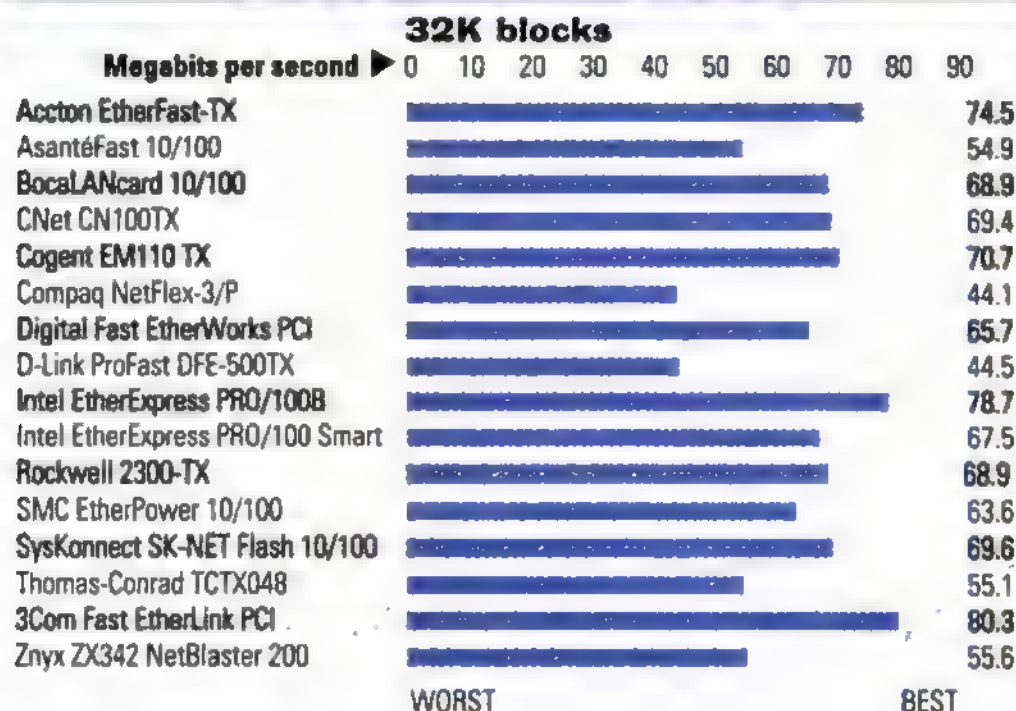
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CIRCLE 293 ON READER SERVICE CARD

Benchmark Tests: Fast Ethernet Adapters

NIC THROUGHPUT—CLIENT



The PCI specification offers a higher bandwidth and easy-to-use Plug and Play, and allows for a *bus-mastering architecture*. Bus mastering permits the card to share the local bus with the main processor, take control of the system bus, and be processor independent, thereby reducing CPU overhead. The PRO/100B includes Intel's new 82557 LAN controller, which has "full scatter gather" capability, allowing multiple data-fragment DMA access when the operating system requests multiple data to be transmitted. The chip set is optimized for low CPU utilization. Similarly, the more expensive PRO/100 Smart adapter uses the Intel i960 processor to offload cycles from the server's CPU. The driver and LAN controller's ability to take advantage of the PCI specification puts less strain on the server's resources.

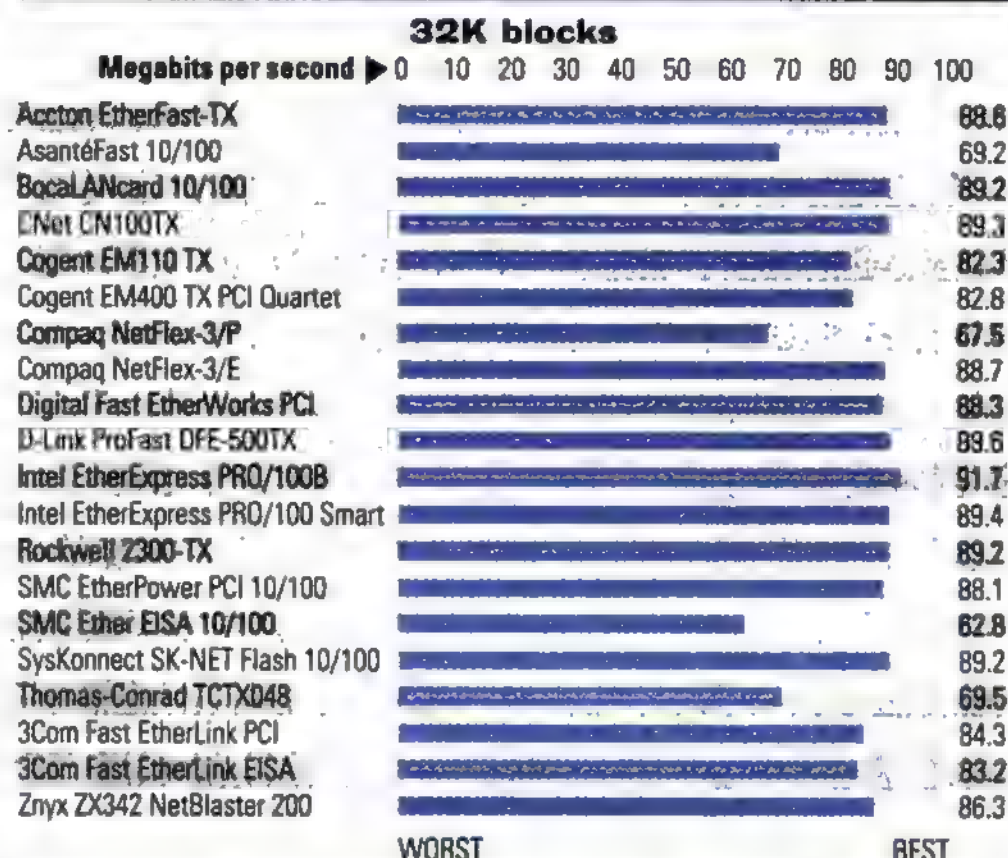
The 3Com Fast EtherLink was the fastest client performer, with 80 Mbps throughput on the client version of our NIC Throughput test, nearly double the 44 Mbps throughput of the D-Link and Compaq PCI adapters. The 3Com was closely followed by the PRO/100B and Accton EtherFast-TX at 78 and 74 Mbps, respectively. To test throughput for the client adapters, we set up a matched pair of each vendor's adapters. Many vendors have implemented special algorithms to offer greater performance between two of the same cards. The 3Com Fast EtherLink employs a technique referred to as Parallel Tasking, which allows for overlapping the processes of transmit and receive operations. Similar solutions are offered by other vendors, such as Cogent's Predictive Pipelining, which alerts the server of the size of upcoming packets.—*Analysis written by Jeffrey G. Witt*

How We Tested

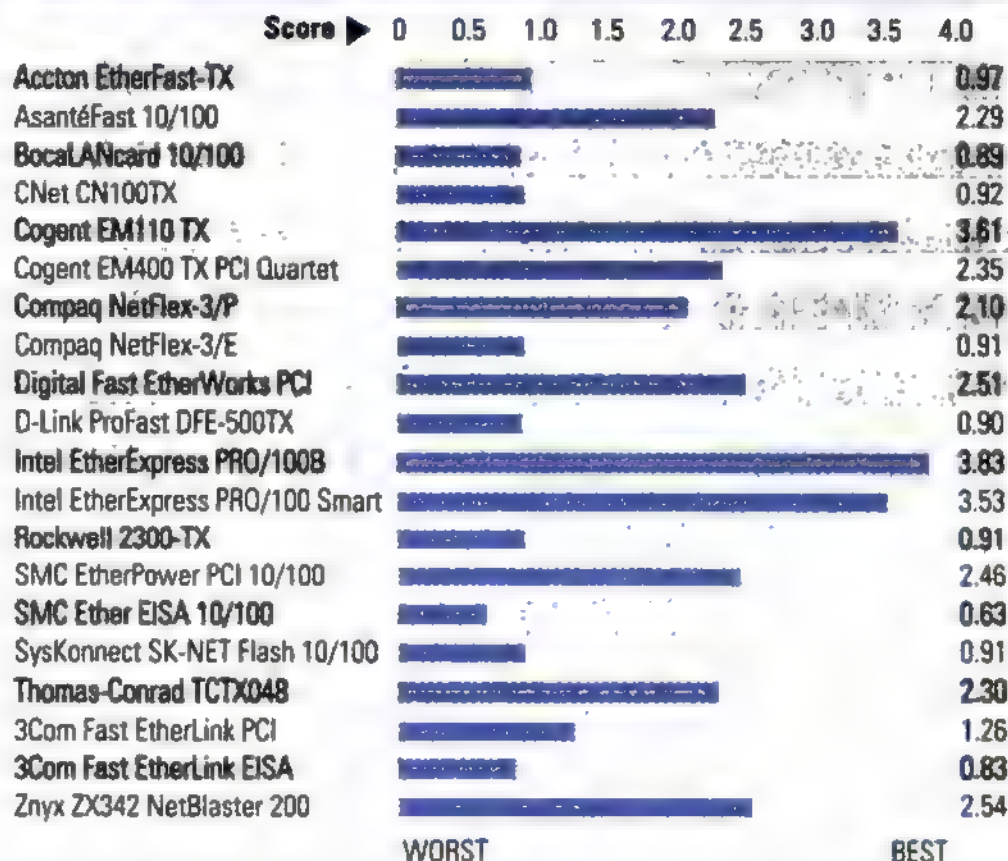
We tested Fast Ethernet adapters in both servers and clients using NetBench 4.0's NIC Throughput test from Ziff-Davis Benchmark Operation. For our server we used NetWare 3.12 on an HP NetServer LF 5/66 with 128MB of RAM and 4GB of hard disk space, equipped with PCI and EISA slots. For the clients, we used eight Compaq XL 5100s with 16MB of RAM, connected over Category 5 cable via a 3Com LinkBuilder FMS 100 shared Ethernet hub.

NetBench 4.0 measures the maximum throughput of a card by sequentially reading data from a shared file that fits into the server cache. With the file

NIC THROUGHPUT—SERVER



NIC PERFORMANCE/EFFICIENCY INDEX—SERVER



in cache, the adapter's activity is isolated from the performance of other server components (such as the speed of the hard disk). All the server's sequential reads are done from memory. We specified block sizes to be read from the shared file; the data was then read in pieces and passed through the network file I/O redirector.

For the server version of our **NIC Throughput** test, we placed each PCI or EISA adapter in the server and then incrementally added clients until we reached an eight-client load. Each Compaq client was using Intel PRO/100 adapters and running MS DOS 6.22 with Novell's VLM 1.2 client. The client version used a matched pair of adapters on the server and client in order to take full advantage of any performance enhancements offered by the vendor. The exception was the Intel PRO/100 Smart, which we matched with an Intel PRO/100. Throughput was measured between the server and one client. We installed only PCI adapters for the client test. To create our **NIC Performance/Efficiency Index** we tracked the server's CPU utilization by running Novell's STAT.NLM during our server adapter test. Each adapter's index score was then calculated by dividing the server adapter's throughput by the recorded CPU utilization.

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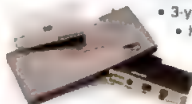
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NOS Compatibility: Novell NetWare; Microsoft® Windows™ 95, Windows NT, Windows for Workgroups, LAN Manager; IBM LAN Server; UNIX®: HP-UX, SunOS, Solaris, IBM AIX, SCO UNIX, Ipd; Apple EtherTalk

Management Support: HP JetAdmin print management software enables consistent installation and management of any HP JetDirect connected printer on the network;

supports SNMP-based network management software

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- Multiple protocols with automatic switching
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 - 3-year return to HP warranty
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- HP JetDirect cards support HP printers with I/O slots



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Workgroup ATM: Tomorrow's Technology Today

By Robert P. Lipschutz

Asynchronous transfer mode (ATM) is like a fine red wine—it's good today but it will fill out beautifully in a few years. Today's first-generation ATM adapters and switches can solve some business needs, but the technology needs further improvement to become the networking solution for everyone. In the long run, ATM promises increased bandwidth, guaranteed quality of service, and improved scalability over today's shared media Ethernet, Token-Ring, and FDDI networks.

We ran data and video throughput tests on ATM products from Adaptec and Fore Systems to get a feel for how ATM stands as a potential workgroup solution. Our testing and product research show that current ATM products must be judged and compared against a backdrop of evolving standards, improving operability, and high prices. But don't despair: This is the path of all new technology. The future

of ATM is not in question—it is the future. And for some specific niches, ATM can work today.

ATM DEFINED

ATM is a switching technology that works with link speeds from T1 (1.544 Mbps) to OC-12 (622 Mbps). The fact that ATM can theoretically run at any speed over any media type makes it the first LAN and WAN technology. This trait will simplify future networks: Instead of a patchwork of Ethernet, ISDN, T1, and other services, you'll be able to have ATM running across the LAN and WAN.

ATM is also an intelligent technology that brings new ways of thinking about transporting network data. Ethernet can claim new speed enhancements, but the fundamental switched connection-oriented character of ATM keeps it leagues ahead. ATM switches can work with ATM-equipped end stations to provide intelligent connections, called virtual circuits, that move

fixed-length 53-byte cells.

The advantage of these intelligent connections is quality of service: ATM guarantees that a specified amount of data will get to a specified destination at a specified speed. In addition, ATM's small, fixed-packet sizes make possible network devices with the low latencies required for time-dependent data like digitized video and sound.

ATM products fall into three categories: workgroup, backbone, and WAN access. We tested workgroup products, which include adapters, switches, and Ethernet access devices that provide the desktop, server, and network connections useful in the LAN. Companies such as Adaptec, Cisco Systems, Efficient Networks, Fore Systems, IBM, Interphase, Newbridge Networks, Whitetree, and ZeitNet have products in this area.

Backbone devices typically connect workgroups together and consist of powerful ATM switches with high-speed backplanes, robust fault-toler-

ATM Workgroup Products

	VENDOR CONTACT INFORMATION		ADAPTERS			ATM SWITCHES
	Telephone	Web address	Product	Speed	PC bus types	Product
Adaptec Inc.	800-934-2766	http://www.adaptec.com	ATM25 ATM155	25 Mbps 155 Mbps	MCA and PCI PCI	None
Bay Networks Inc.	800-822-9638	http://www.baynetworks.com	None	—	—	LattisCell
Cisco Systems Inc.	800-859-2726	http://www.cisco.com	Cisco 155 ATM Adapter*	155 Mbps	PCI	LightStream 100 LightStream 1010
Efficient Networks Inc.	214-991-3884	http://www.efficient.com	ENI-155E ENI-155P	100 and 155 Mbps 155 Mbps	EISA PCI	None
FORE Systems Inc.	412-933-6244	http://www.fore.com	ESA-200EPC PCA-200PC	100 and 155 Mbps 100 and 155 Mbps	EISA PCI	ASX-200WG
IBM Corp.	800-426-4968	http://www.ibm.com	Turboways 25 Turboways 100 Turboways 155	25 Mbps 100 Mbps 155 Mbps	ISA and MCA MCA MCA	8260 Multiprotocol Intelligent Switching Hub 8282 Nways ATM Workgroup Concentrator
Interphase Corp.	800-327-8638	http://www.iphas.com	4815 EISA ATM Adapter 5515 PCI ATM Adapter	155 Mbps 155 Mbps	EISA PCI	None
Newbridge Networks Inc.	800-368-4843	http://www.newbridge.com	Vivid EISA NIC	155 Mbps	EISA	Vivid ATM Workgroup Switch
Optical Data Systems Inc.	214-234-6400	http://www.ods.com	AnyCell ATM Desktop Adapter*	25 Mbps	ISA	AnyCell ATM 25 Switch
3Com Corp.	800-638-3266	http://www.3com.com	None	—	—	Cellplex 7000
Whitetree Inc.	415-855-0855	http://www.whitetree.com	Adaptec and Madge Networks adapters*	25 and 155 Mbps	PCI	WS3000
ZeitNet Inc.	408-986-9100	http://www.zeitnet.com	ZATM	155 Mbps	EISA and PCI	None

* The vendor resells adapters from another manufacturer

ance, and network management capabilities. Here Cisco Systems, Fore Systems, Newbridge Networks, and Optical Data Systems lead the way. WAN access devices have the capability to work with public carrier equipment and will form the basis of public ATM networks like those of AT&T, MCI, MFS DataNet, and Sprint.

Specifically, ATM will be available in four flavors in the LAN and backbone: 25.6-, 100-, and 155-Mbps adapters and corresponding switch modules are currently available, and Cisco Systems and Fore Systems plan to have 622-Mbps switch modules on the market soon. In the near term, we expect 25.6 Mbps over Category 3 UTP copper and 155 OC-3 SONET (synchronous optical network) over Category 5 UTP copper and fiber will become the most prevalent in the workgroup.

IBM, Adaptec, and Optical Data Systems are betting on 25.6-Mbps ATM to the desktop, claiming that the hardware is more reasonably priced than 155 Mbps hardware and that 25.6 Mbps is sufficient bandwidth for most

of today's applications. Fore Systems, Newbridge Networks, and ZeitNet are concentrating on 155-Mbps SONET adapters, reasoning that when network managers decide to change their network infrastructures they'll want a significant performance improvement. Ultimately, the fate of 25.6-Mbps ATM versus 155-Mbps ATM will depend on the price differential.

WORKGROUP ATM TODAY

You can benefit from ATM today if you fall into one of three categories. First, if your network has large amounts of video, voice, or image data traversing in real time, workgroup ATM may be the answer—but only if you are willing to invest in vertical-market applications development. Second, if you need very fast guaranteed delivery times, such as on a financial trading floor, ATM is worth the trouble. Finally, if you want to get your feet wet with ATM in a pilot project, now is the time to get started.

In our testing, we found products that were clearly first-generation, with incomplete driver sets and incomplete compliance with rapidly evolving standards. The largest bottleneck slowing ATM adoption, however, is the lack of application support. Existing applications and operating systems do not support native ATM and therefore do not benefit from the quality of service and guaranteed end-to-end delivery that will typify future solutions.

The first steps taken by the ATM standards committees toward interoperability are Classical IP for existing IP networks, and the more general LAN Emulation for IP, IPX, and other networks. The Adaptec ATM adapters worked fine using Windows NT clients and servers with Classical IP, but LAN Emulation wasn't ready in time for our testing. Fore Systems used Fore IP, a proprietary variant of Classical IP.

The next step, probably a year or more away, will be native ATM hooks in operating systems and applications.

Almost all ATM adapter vendors offer ATM APIs so applications can be programmed to communicate directly with vendors' specific ATM adapters, but a lack of standards and little mainstream application work makes this a vertical development proposition. If you want to take full advantage of ATM today in the workgroup, plan on developing your own applications.

A quick survey of ATM sites bears this out. Today you'll find ATM in universities, research centers, and larger corporations on mostly Unix workstations with a smattering of PCs usually fitted with Windows NT. These sites are working closely with vendors to develop in-house applications and improve drivers, performance, and interoperability.

If you want to experiment with ATM in PC-based networks, you'll need PCI adapters that work with 32-bit operating systems like Windows NT, NetWare servers, and possibly Windows 95 in the near future. Today you'll find Windows NT is the best-supported OS in the PC space, with a small number of ATM vendors providing NetWare server drivers.

THE FUTURE

We see ATM becoming the workgroup standard around the year 2000. Additional important work is being done on an ATM service called Available Bit Rate (ABR) that will govern traffic management for today's common bursty data traffic. In general, traffic management and congestion control standards, important to ensure quality of service, are still evolving.

Still, ATM's future in the workgroup hinges on application integration. What's needed are standard ATM APIs and major vendors following suit with applications based on the standards. Only when Novell, Microsoft, IBM, Oracle, and others develop ATM-compliant applications will mainstream networks reap the benefit. Until then, ATM will be found mostly in the cellars.

LAN-TO-ATM ACCESS SWITCHES

Speed

	None
155 Mbps	Centillion Speed Switch 100 (FDDI or Token-Ring to ATM), EtherCell (Ethernet to ATM)
155 Mbps 155 Mbps	ATM Interface Processor modules for Cisco 7000 and Catalyst 5000 (Ethernet or FDDI to ATM)
	None
100 and 155 Mbps 155 Mbps	LAX-20 (Ethernet, FDDI, or Token-Ring to ATM) 8281 ATM LAN Bridge (Ethernet or Token-Ring to ATM)
25 and 100 Mbps	
	None
155 Mbps 25 Mbps	Vivid Yellow Ridge (Ethernet to ATM) Infinity hub modules (Ethernet, FDDI, or Token-Ring to ATM)
155 Mbps	Cellplex 7200 (Ethernet to ATM), LinkSwitch 2700 (Ethernet to ATM)
25 and 155 Mbps	WS3000 (Ethernet to ATM)
	None

After going down to Research and up to Sales and over to Finance I had this overwhelming pile of papers on my desk that were filled with numbers and words and facts and I was having a huge brain cramp. And as I sat there thinking about how to turn all this input into a plan that

Why I sat staring at my computer screen waiting for a divine act of God to figure it all out for me.

would mean something and look cool and inviting instead of boring and dull when I presented it,

I realized that I had been sitting there for over two hours



just staring at a mountain of information and the only

thing I had typed were the words "sales plan and presentation." I figured that at four words every

two hours, I wouldn't have this thing done until the year 2000. And that was way past my deadline.

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NetWare ODI client, NetWare server, NDIS 2.1 and 3.0, Windows 95, and TCP/IP Packet Drivers. But we found no installation utilities or instructions with the drivers. The only included utility is Acctest, an easy-to-use diagnostic tool that determines whether the card is operating properly.—Charles Lin

Accton EtherFast-TX PCI. List price: \$235. Accton Technology Corp., 1962 Zanker Rd., San Jose, CA 95112; 800-926-9288, 408-452-8080; fax, 408-452-8988; Web, <http://www.accton.com.tw>.

Circle 441 on reader service card

Asanté Technologies Inc.

AsantéFast 10/100 PCI Adapter

While it offers line-speed auto-negotiation capability and an easy-to-use installation program for a low \$200 street price, the AsantéFast 10/100 PCI adapter did not perform well on our client throughput testing, placing in the bottom third of the products reviewed. Its server CPU utilization was outstanding—just 30 percent with eight clients—but server throughput results were among the lowest we saw. If you've got both PCs and Power Macs, you might consider the AsantéFast, the only other card reviewed besides the Rockwell 2300-TX that included Power Mac drivers—but the card was bested by the Rockwell NIC on our throughput test runs.

The AsantéFast 10/100 offers true auto-negotiation through a single RJ-45 connector that auto-senses 10- or 100-Mbps operation, letting you upgrade to 100 Mbps without any reinstallation or additional configuration. Using the Fast Ethernet auto-negotiation capability, the card can auto-sense a full-duplex transmission.

The installation guide was logically arranged and easy to use, containing troubleshooting tips and concise instructions for installing the adapter and drivers. However, Asanté includes no information on installing the adapter on Windows 95, and we encountered problems: The installation program detected the card but Windows 95 could not install the driver for it; we selected the proper driver manually and it successfully installed.

Though it had a sparse selection of drivers—among them NetWare server,

Windows 3.x, LAN Manager, and Sun-Soft PC/NFS—Asanté was one of two vendors to include Macintosh drivers with its card.—Arun R. Desai

AsantéFast 10/100 PCI Adapter. List price: \$269. Asanté Technologies Inc., 821 Fox Ln., San Jose, CA 95131-1601; 800-662-9686, 408-435-8388; e-mail, sales@asante.com; Web, <http://www.asante.com>.

Circle 442 on reader service card

Boca Research Inc.

BocaLANcard 100/10

In the middle of the pack in client and server throughput testing, the BocaLANcard 100/10 showed excessive CPU utilization, with a Performance/Efficiency Index score among the bottom one-third of products tested. Its no-frills installation program and lack of line-speed auto-sensing left us further unimpressed.

The BocaLANcard 100/10 (\$190 street) has two RJ-45 connectors—one for 10-Mbps and one for 100-Mbps connections—and you must move the cable from the 10-Mbps port to the 100-Mbps port to upgrade. However, no other configuration changes are necessary. The BocaLANcard 100/10 does not yet support full-duplex transmission at either speed.

The basic installation program just copies the requested drivers; you must configure parameters manually. The instruction manual does provide procedures and changes needed in configuration files, so an experienced network manager should not have much difficulty with installation. A standard collection of device drivers and instructions are provided for NetWare ODI clients, NetWare servers, OS/2, NDIS 2.1 and 3.0, Microsoft LAN Manager, and Digital Pathworks, and the card installed without a problem under Windows 95.

Boca provides free technical support with a toll call, but expect long waits. Boca's Priority Service, 900-number telephone support for \$2 per minute, guarantees an immediate response.—CL

BocaLANcard 100/10. List price: \$279. Boca Research Inc., 1377 Clint Moore Rd., Boca Raton, FL 33487-2722; 407-997-6227; fax, 407-994-5848; Web, <http://www.boca.org>.

Circle 443 on reader service card

CNet Technology Inc.

CNet CN100TX

As a client card, the CNet CN100TX scored slightly above average on our throughput testing. But the CN100-TX (\$199 street) returned a lackluster performance as a server card with high CPU utilization—more than 90 percent on the test run with 32K blocks. Moreover, the card lacks the ability to auto-sense line speed and requires that you modify client configurations to upgrade to 100 Mbps.

The CN100TX comes with an automated client installation utility, which configures speed and full-duplex operation, and includes diagnostics. You can view the current configuration or run a custom installation. In our test-bed, the setup utility failed to load the ODI driver properly. We installed the driver using Novell's standard DOS ODI installation procedure with no problems. Installation was easy under Windows 95, which auto-detected the card and installed the driver for Digital's Fast Ethernet chip set.

The CN100TX does not automatically switch from 10 to 100 Mbps. You must physically switch the RJ-45 cable from one jack to the other. Furthermore, the CN100TX's driver, like D-Link's, does not automatically determine that you've switched, so you must either reinstall the driver for the card in each client or make a change in the client's configuration files.

The documentation for the CN100TX is a slim 12-pages. This card is only for LAN administrators who can troubleshoot without the aid of software utilities, and only for those who will not be upgrading many clients from 10 to 100 Mbps after the card is installed.—Gordon McComb

CNet CN100TX. List price: \$259. CNet Technology Inc., 2199 Zanker Rd., San Jose, CA 95131; 800-486-2638, 408-954-8000; fax, 408-954-8866.

Circle 444 on reader service card

Cogent Data Technologies Inc.

Cogent EM110 TX PCI, Cogent EM400 TX PCI

Cogent's Fast Ethernet adapters offer solid performance and options for specific networks' needs. The Cogent EM110 TX PCI (\$179 street) has an auto-sensing RJ-45 connector for

Fast Ethernet Adapters

both 10-Mbps and 100-Mbps line speeds. For networks with Thin Ethernet cabling, the EM110 TX Combo (\$229 street) comes with a BNC connector for 10-Mbps Ethernet. Aimed at the server market, the Cogent EM400 TX PCI adapter, with a street price of \$1,195, offers four 100-Mbps-only ports to connect up to four separate segments on one PCI bus.

Both the EM110 TX and the EM400 TX can operate full duplex at 10 and 100 Mbps. Combining Bus Mastering with efficient drivers, the EM110 TX had the lowest CPU utilization (22 percent) of all products tested and the second-highest Performance/Efficiency Index score, behind only the Intel PRO/100B. The CPU utilization on the EM400 TX was not as good but still in the top one-third of the products tested.

Cogent's Predictive Pipelining, a proprietary performance-enhancing technique, increases throughput by notifying the receiving adapter—which must be another Cogent card—that a packet is about to arrive. Both the EM110 TX and EM400 TX adapters were in the middle of the pack on our server throughput testing, but on the client throughput testing, the EM110 TX was among the top four performers.

Because the EM110 TX auto-senses the line speed, changing from a 10- to 100-Mbps network requires no client changes. The EM110 TX includes a comprehensive collection of drivers including ODI clients, Novell servers, OS/2, NDIS 2.1 and 3.0, Digital Pathworks, Nextstep, and Solaris x86. Intended as a server NIC, the EM400 TX ships with drivers for Novell servers, Windows NT Server, Artisoft LANtastic, OS/2 LAN Server, Pathworks, and Microsoft LAN Manager.

Cogent included Windows 95 drivers, but we were unable to get the cards to function with them or the generic driver for the Digital chip set; the company says it will have updated Windows 95 drivers available for downloading. Unfortunately, you must manually install the drivers (no installation utility is included) from directions that are in text files.—CL

Cogent EM110 TX PCI. List price: \$195.
Cogent EM400 TX PCI. List price: \$1,298. Cogent Data Technologies Inc., 640 Mullis St., Friday Harbor, WA 98250;

800-426-4368, 206-603-0333; fax, 206-603-9223; Web, <http://www.cogentdata.com>.
Circle 445 on reader service card

Compaq Computer Corp.

**NetFlex-3/P,
NetFlex-3/E**

Compaq's adapters have a module feature that allows you attach either 100Base-TX or 100VG-AnyLAN modules to a 10-Mbps card, making them the only products in our roundup that support both fast Ethernet standards. (We tested each card with the 100Base-TX module) While assembling the additional piece on each card makes upgrading more complicated, this unique upgrade path may be right for administrators who aren't sure which Fast Ethernet technology they'll eventually adopt.

However, unless you're purchasing a system from Compaq with the NIC pre-installed, the NetFlex-3/P's poor performance and estimated street price of a whopping \$280 make it an unlikely choice. And though the NetFlex-3/E was the best-performing EISA card we tested, it also has a high street price of \$280.

With NetFlex 3/P's on the clients and server, the NetFlex-3/P placed dead last on the client versions of our NIC Throughput tests; it never rose above 45 Mbps throughput. The NetFlex-3/P card had an average performance on the server version of our NIC Throughput test, and a midrange score on the Performance/Efficiency Index.

As a server NIC, the NetFlex-3/E had the best CPU utilization and Performance/Efficiency Index score of the three EISA cards we tested. The NetFlex-3/E delivered an impressive 88.6 Mbps on the server version of our NIC Throughput test, ahead of many of the PCI cards.

Today, both the NetFlex-3/P and the NetFlex-3/E support full duplex at 10-Mbps only, with 100-Mbps full duplex to be added next year. They have auto-sensing to determine when you're using 100Base-TX.

As with other NICs we reviewed, the cards include no setup utility, so we had to manually load the drivers. The user guide dealt with hardware installation of the NICs on various Compaq server machines, but did not include information about client installation or PCs from other vendors.—ARD

NetFlex-3/P. Street price: \$280. **NetFlex-3/E.** Street price: \$280. Compaq Computer Corp., 20555 State Hwy. 249, Houston, TX 77070-2698; 800-345-1518; fax, 713-518-1442; Web, <http://www.compaq.com>.

Circle 446 on reader service card

Digital Equipment Corp.

**Digital Fast EtherWorks
PCI 10/100**

Excellent throughput and efficiency make the Digital Fast EtherWorks PCI 10/100 adapter a top performer on most of our benchmark tests. This feature-packed adapter (\$215 street) offers advanced performance enhancements and easy-to-use installation software. Its auto-detecting RJ-45 connector makes the transition from 10- to 100-Mbps automatically, requiring no changes to the clients.

The Fast EtherWorks card uses the same Digital 21140 processor used by 12 of the 15 vendor adapters in this roundup. Windows 95 includes a driver for the Digital chip set, so all of the cards that use it should be able work with this generic driver. Digital's Parallel Cut-Through technology and Capture Effect Avoidance contribute to its good performance. Parallel Cut-Through sends data packets directly to the wire if the card's buffer is empty. Capture Effect Avoidance ensures that with a one-to-one connection (as in a server-to-client case), the traffic between adapters is balanced so that one node doesn't monopolize the transmission. The Fast EtherWorks also implements full duplex for both 10- and 100-Mbps speeds.

The EZWorks utility makes driver installation a breeze, prompting you for every configuration option and providing drivers for NetWare DOS clients, NetWare servers, NDIS 2.1 and 3.0, SCO Unix, and Windows 95. EZWorks also provides standard diagnostic tests and PCI configurations. More drivers are on Digital's BBS, and an SNMP agent that relays statistics to an SNMP management console will be available by the time you read this.—CL

Digital Fast EtherWorks PCI 10/100. List price: \$249. Digital Equipment Corp., 550 King St., Littleton, MA; 800-457-8211; 508-692-2562; fax, 508-392-0603; Web, <http://www.networks.digital.com>.

Circle 447 on reader service card



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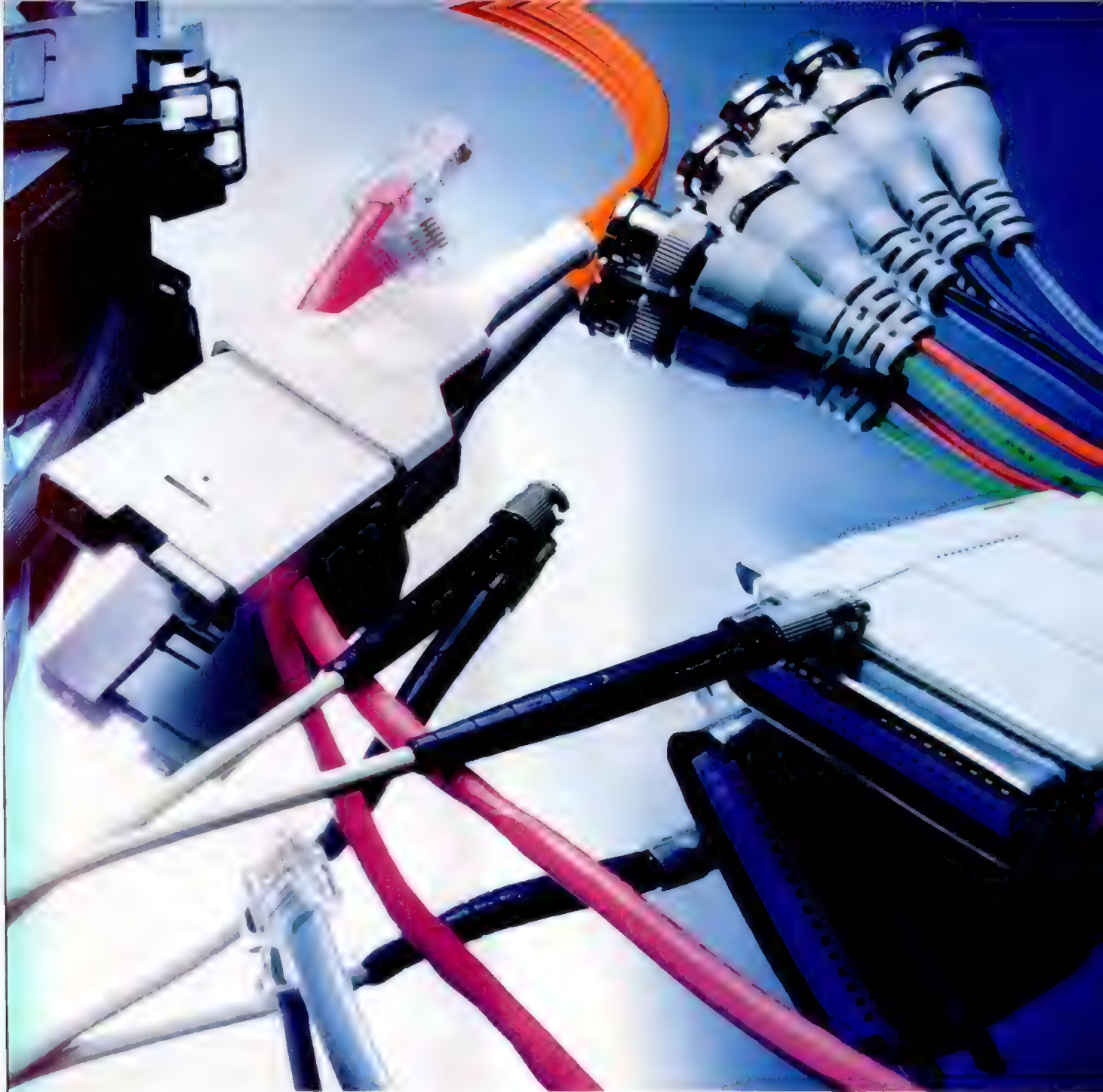
**Can your
network
do this?**

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D-Link Systems Inc. USA

D-Link ProFast DFE-500TX

At a street price of \$175, the D-Link ProFast DFE-500TX is priced attractively. But the DFE-500TX suffers from average throughput and a very low Performance/Efficiency Index score.

The DFE-500TX also lacks auto-sensing. Two RJ-45 jacks are provided for 10- and 100-Mbps connections: To upgrade your network from 10- to 100-Mbps operation, you must move the network cable from one jack to the other and, as with the CNet adapter, either reinstall the driver or modify the client's configuration files.

D-Link's 12-page installation manual provides limited information, and it doesn't explain how to install drivers for

the card. The only instructions are for copying the driver file to a network directory on the client. D-Link includes a standard selection of drivers, including NetWare ODI, NetWare server, and NDIS 2.1 and 3.0. We installed the NetWare driver using the Novell's DOS installation program and encountered no problems.

We could recommend the DFE-500TX had it offered auto-sensing, an installation program, or turned in reasonable test results, but it misses the mark.—*GM*

D-Link ProFast DFE-500TX. List price: \$195. D-Link Systems Inc. USA, 5 Mu-sick, Irvine, CA 92718; 800-326-1688, 714-455-1688; fax, 714-455-2521; Web, <http://www.dlink.com>.

Circle 448 on reader service card

Intel Corp.

**Intel EtherExpress
PRO/100B,
Intel EtherExpress
PRO/100 Smart**


These two PCI adapters from Intel offer outstanding performance at very attractive prices. The Intel EtherExpress PRO/100B (\$149 street) had one of the lowest prices of the products reviewed and was consistently in the top tier on all our benchmark tests. The PRO/100B is also the smallest adapter we looked at, requiring less power and generating less heat than other NICs.

100VG-AnyLAN: The Other 100-Megabit Solution

By Wayne Rash, Jr.

While it enjoys widespread market support, 100Base-T is not the only fast networking solution available. If you already have a 10Base-T Ethernet network, you might also consider a move to a standard called 100VG-AnyLAN, especially if you're eyeing voice and video applications. Developed by a consortium that includes Hewlett-Packard and AT&T, 100VG-AnyLAN is a 100-Mbps technology designed specifically to work with existing 10Base-T cable systems.

100VG meets the IEEE 802.12 standard released earlier this year and has similar cable requirements to 10Base-T. 100VG-AnyLAN runs over Category 3 or 5 cabling and has a maximum network diameter (total network length) of 2,500 meters. While 10Base-T supports as many as four hubs in a single segment, 100VG-AnyLAN supports up to five cascaded hubs at a depth of three layers. (See the sidebar "Cascading Hubs" on page tktk). This means that many companies can simply plug their 100VG cards into their servers and workstations, attach new hubs, and get going. By contrast, Fast Ethernet has a limit of two hubs between end nodes and a maximum network diameter of 205 meters. Switching from Ethernet to

Fast Ethernet may mean rewiring and reconfiguring your network. There is a catch, though. 100VG requires four twisted pairs per connection rather than the two required for 10Base-T and 100Base-TX.

100VG also differs from 10Base-T in the way that data traffic is managed on the network. Unlike traditional 802.3 Ethernet, which is a collision-based architecture, 100VG uses Demand Priority Architecture to manage traffic. Demand Priority means that each hub keeps track of the requests to transmit for each node attached to it. Only one node is given permission to send data at any time. This eliminates collisions, and in the process makes the network more deterministic, allowing video to arrive with all of the frames in order. In addition, different sources of data can be given different levels of priority: Servers can be assured that they won't have to wait for workstations, for example. However, priorities either have to be programmed into applications or configured via software for a particular client PC.

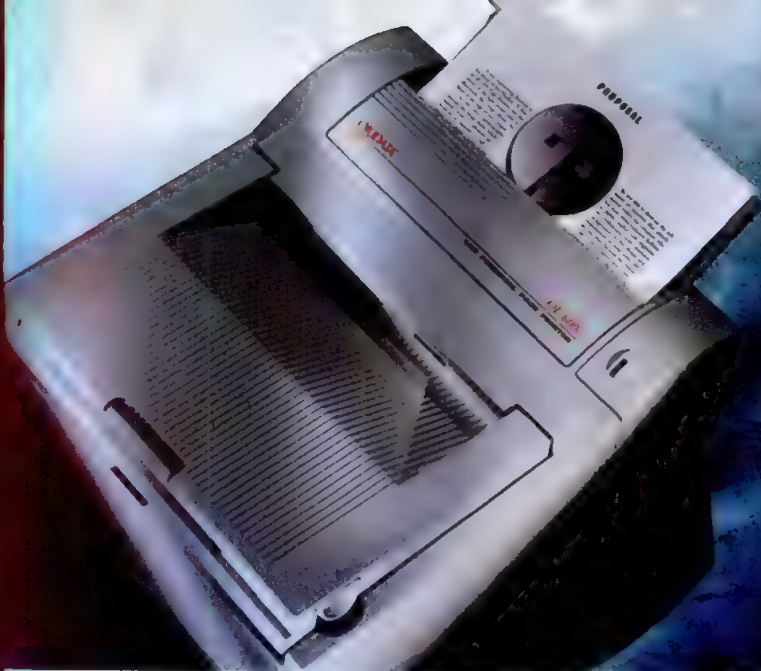
A year ago, the 100VG marketplace was defined mostly by Hewlett-Packard, which was a primary force in designing the standard and in getting it accepted by the IEEE. Since then, a

number of other companies have joined HP in the 100VG marketplace. HP claims that 100VG now has about 40 percent of the fast Ethernet marketplace, measured on the number of installed ports. This is due primarily to the fact that 100VG products shipped before those of 100Base-T.

Industry support is rapidly gathering around Fast Ethernet. The Fast Ethernet alliance boasts a 75-vendor membership, including most major players, while the 100VG-AnyLAN forum has only 24. Important 100VG-AnyLAN players in addition to HP include AT&T, Compaq, IBM, Pure Data, and Thomas-Conrad, all of which are currently shipping products.

A few features of 100VG are still emerging. For example, 100VG switches were just finding their way to the market at press time. This is partly because switching hubs are less necessary to 100VG than they are to Fast Ethernet, since Demand Priority serves some of the same function by eliminating collisions. The ability to support Token-Ring frame types has yet to be delivered.

While it's unlikely that 100VG will knock Fast Ethernet out of the running, it is sure to stick around as a high speed networking solution.



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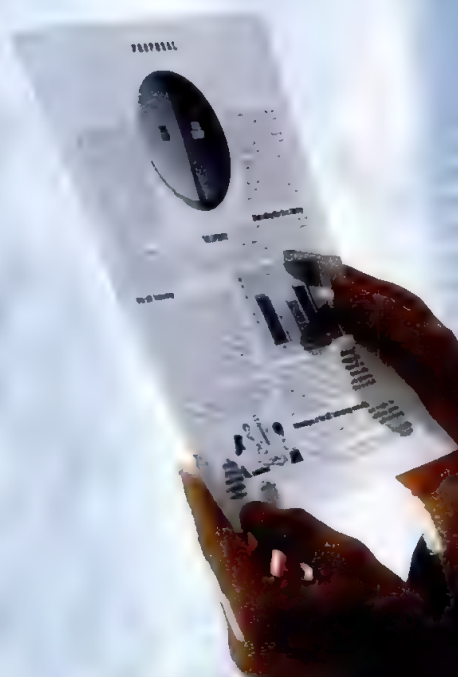
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SUMMARY OF FEATURES

Fast Ethernet Network Adapters

	Accton Technology Corp. Accton EtherFast-TX PCI	Asanté Technologies Inc. AsantéFast 10/100 PCI Adapter	Boca Research Inc. BocaLANcard 100/10	CNet Technology Inc. CNet CN100TX	Cogent Data Technologies Inc. EM110 TX	Cogent Data Technologies Inc. EM400 TX PCI	Compaq Computer Corp. NetPlex-3/P
■ YES ■ NO							
In alphabetical order by company							
List price	\$235	\$269	\$279	\$259	\$259	\$1,298	N/A
Estimated street price	\$199	\$200	\$190	\$199	\$199	\$1,195	\$280
General Features							
Bus type/Data-path width	PCI/32 bits	PCI/32 bits	PCI/32 bits	PCI/32 bits	PCI/32 bits	PCI/32 bits	PCI/32 bits
PCI version number	2.0	2.0	2.0	2.1	2.1	2.1	2.0
10-/100-Mbps operation	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
10-/100-Mbps auto-sensing	■	■	■	■	■	N/A	■
10-/100-Mbps auto-negotiation	■	■	■	■	■	N/A	■
20-/200-Mbps operation	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Number of RJ-45 connectors	2	1	2	2	1	4	1
Number of combined RJ-45/BNC connectors	None	None	None	None	None	None	None
Number and type of other connectors	1 BNC	None	None	None	None	None	1 BNC
Topology	Star	Star	Star	Star	Star	Star	Star
Network status indicators	■	■	■	■	■	■	■
Power indicators	■	■	■	■	■	■	■
RG-58 support	■	■	■	■	■	■	■
Processor	DEC 21140	DEC 21140	DEC 21140	DGC DC1010BA	DEC 21140	DEC 21140	TI ThunderLAN
Buffer RAM	4K receive FIFO, 2K transmit FIFO	4K receive FIFO, 2K transmit FIFO	4K receive FIFO, 2K transmit FIFO	4K receive FIFO, 2K transmit FIFO	4K receive FIFO, 2K transmit FIFO	4K receive FIFO, 2K transmit FIFO	None
Performance enhancement technique	PCIMUD	Parallel cut-through	Parallel cut-through	Sequential tasking	Predictive pipelining	Predictive pipelining	Adaptive performance prioritization
Remote boot PROM support	■	■	■	■	■	■	■
Flash ROM on-board	■	■	■	■	■	■	■
DMI compliant	■	■	■	■	■	■	■
Network and board diagnostics	■	■	■	■	■	■	■
SNMP agent	■	■	■	■	■	■	■
Driver Support							
NetWare 3.x/4.x server	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Novell ODI Client DOS	■	■	■	■	■	■	■
Novell ODI Client OS/2	■	■	■	■	■	■	■
Latest NDIS version number	3.0	3.0	3.0	3.0	3.0	3.0	3.0
DEC PathWorks	■	■ *	■	■	■	■	■
IBM OS/2	■	■	■	■	■	■	■
IBM OS/2 LAN server	■	■	■	■	■	■	■
LANtastic	■	■	■	■	■	■	■
Macintosh System 7.5x	■	■	■	■	■	■	■
Microsoft LAN Manager	■	■	■ (via OS)	■	■	■	■
Microsoft Windows 95	■	■	■	■	■	■	■ (via OS and BBS)
Microsoft Windows for Workgroups	■	■	■	■	■	■	■
Microsoft Windows NT 3.5x	■	■	■	■	■	■	■
NetWare Lite	■	■	■	■	■	■	■
Sun Solaris X86	■	■	■	■	■	■	■
SunSoft PC/NFS	■	■	■	■	■	■	■
UnixWare 2.x	■	■	■	■	■	■	■
VINES Client/Server 6.0	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
FTP TCP/IP or NCSA TCP/IP packet drivers	■ ■ (via BBS)	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Technical Support							
Warranty	Lifetime	Lifetime	5 years	Lifetime	Lifetime	Lifetime	3 years
Free technical support (eastern time)	9:00-9:00 M-F	9:00-9:00 M-F	8:00-6:30 M-F	11:00-9:00 M-F	10:00-8:00 M-F	10:00-8:00 M-F	24 hours, 7 days
Toll-free telephone number	800-926-9288	800-622-7464	None	800-486-2338	800-426-4368	800-426-4368	800-652-6672

N/A—Not applicable: The product does not have this feature. * For Macintosh clients only

Fast Ethernet Adapters

Continues

Compaq Computer Corp. NetPlex-3/E	Digital Equipment Corp. Digital Fast EtherWorks PCI 10/100	D-Link Systems Inc. USA D-Link ProFast DFE-500TX
N/A	\$249	\$195
\$280	\$215	\$175
EISA/32 bits	PCI/32 bits	PCI/32 bits
N/A	2.0	2.0
■ ■	■ ■	■ ■
■	■	■
■ ■	■ ■	■ ■
1	1	2
None	1	None
1 BNC	None	None
Star	Star	Star
■	■	■
■	■	■
TI ThunderLAN	DEC 21140	DEC 21140
None	4K receive FIFO, 2K transmit FIFO	4K receive FIFO, 2K transmit FIFO
Adaptive performance prioritization	Parallel cut-through	Parallel tasking
■	■	■
■	■	■
■	■	■
■	■	■
■ ■	■ ■	■ ■
■	■ (via BBS)	■
3.0	3.0	3.0
■	■	■
■	■	■
■	■	■
■	■	■
■	■	■
■ (via OS and BBS)	■	■
■	■	■
■	■	■
■	■	■
■	■	■
■ ■	■ ■	■ ■
■ ■	■ ■	■ ■
3 years	Lifetime	Lifetime
24 hours, 7 days	8:00-5:00 M-F	10:00-5:00 M-F
800-652-6672	800-354-9000	None

The EtherExpress PRO/100 Smart (\$795 street), targeted at the server market, also performed well and had very low CPU utilization, making it worth considering as a server card despite its higher price.

In our testing, with the PRO/100B on the client and the server, the PRO/100B had the best Performance/Efficiency Index score of any product reviewed. It had the highest throughput rate as a server adapter, and as a client adapter it was second only to the 3Com Fast EtherLink.

Positioned as a server NIC, the EtherExpress PRO/100 Smart uses Intel's i960 RISC processor to decrease CPU utilization. With the PRO/100B on the clients, the PRO/100 Smart had an outstanding Performance/Efficiency Index score—third overall—and on the 64-byte block version of our CPU Utilization test it had an amazing 35.7 percent; every other card we looked at was higher than 90 percent.

The PRO/100B meets the Fast Ethernet auto-negotiation standard, and the installation even lets you set the card for either half- or full duplex, or to auto-negotiate between the two. The PRO/100 Smart has a single RJ-45 jack that auto-senses line speed, but does not have auto-negotiation or full-duplex transmission features.

The installation guide contains a quick-start section for installation on DOS, Windows 3.x, Windows NT, and Windows 95 PCs. The EtherExpress cards come with automatic setup and diagnostic utilities. But the setup utility did not create a complete NET.CFG file on our NetWare client, requiring additional configuration.

Both cards are compliant with the Desktop Management Interface (DMI) specification and include an agent for Simple Network Management Protocol (SNMP) monitoring.—ARD

Intel EtherExpress PRO/100B. List price: \$169. **Intel EtherExpress PRO/100 Smart.** List price: \$895. Intel Corp., 5200 N.E. Elam Young Pkwy., Hillsboro, OR 97124-6497; 800-538-3373, 503-264-7354; Web, <http://www.intel.com>.

Circle 449 on reader service card

Rockwell Network Systems

Rockwell 2300-TX

If your workgroup has both PCs and Power Macs, for an NIC you might consider the Rockwell 2300-TX (\$239 street), one of two cards we reviewed that included Macintosh drivers. The card has a line-speed auto-sensing feature, but limited driver support and slightly below-average performance limit its appeal. On the server, the 2300-TX showed good throughput with eight clients (almost 90 Mbps), but server CPU utilization was higher than average.

A single RJ-45 connector with auto-

sensing makes the upgrade from 10 to 100 Mbps simple: No changes are required on the clients. The adapter is capable of full duplex for 10- and 100-Mbps line speeds. The Rockwell 2300-TX has sturdier construction and a

cleaner design than other cards; it slides smoothly into the PCI slot.

At the time of this review Rockwell supplied just four drivers—Novell ODI client, Novell server, Power Mac, and Windows NT—but it was the only adapter tested besides the AsantéFast that provided Power Mac drivers. The adapter also installed under Windows 95 using the generic driver for the Digital 21140 chip set. Installation and diagnostic utilities were unavailable for our review but Rockwell supplied installation instructions for NetWare and Windows NT.—CL

Rockwell 2300-TX 10/100 PCI. List price: \$245. Rockwell Network Systems, 7402 Hollister Ave., Santa Barbara, CA 93117-2590; 800-262-8023, 805-968-4262; fax, 805-968-6478, Web, <http://www.rns.rockwell.com>.

Circle 450 on reader service card

Standard Microsystems Corp.

SMC EtherPower 10/100,
SMC Ether 10/100

Both of Standard Microsystems Corp.'s cards, the SMC EtherPower 10/100 (PCI bus) and SMC Ether 10/100 (EISA), come with an EZStart installation program, designed to ease the

The Intel EtherExpress
PRO/100B was
consistently in the top
tier on all our
benchmark tests.

SUMMARY OF FEATURES

Fast Ethernet Network Adapters



■ YES ■ NO

In alphabetical order by company

	Intel Corp. Intel EtherExpress PRO/100B	Intel Corp. Intel EtherExpress PRO/100 Smart	Rockwell Network Systems Rockwell 2300-TX	Standard Microsystems Corp. SMC Ether- Power PCI 10/100	Standard Microsystems Corp. SMC Ether EISA 10/100	SysKonnect Inc. SysKonnect SK-NET Flash 10/100 PCI	Thomas-Conrad Corp. TCTX048 100-Base-TX PCI Adapter
List price	\$169	\$895	\$245	\$169	\$269	\$259	\$215
Estimated street price	\$149	\$795	\$239	\$159	\$255	\$215	\$200
General Features							
Bus type/Data-path width	PCI/32 bits	PCI/32 bits	PCI/32 bits	PCI/32 bits	EISA/32 bits	PCI/32 bits	PCI/32 bits
PCI version number	2.1	2.1	2.0	2.0	N/A	2.0	2.0
10-/100-Mbps operation	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
10-/100-Mbps auto-sensing	■	■	■	■	■	■	■
10-/100-Mbps auto-negotiation	■	■	■	■	■	■	■
20-Mbps/200-Mbps operation	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Number of RJ-45 connectors	1	1	1	1	1	1	2
Number of combined RJ-45/BNC connectors	None	None	1	None	None	None	None
Number and type of other connectors	None	None	None	1 DB9	1 DB9	None	None
Topology	Star	Star	Bus	Star	Star	Star	Star
Network status indicators	■	■	■	■	■	■	■
Power indicators	■	■	■	■	■	■	■
RG-58 support	■	■	■	■	■	■	■
Processor	Intel 82557	Intel 82558	DEC 21140	DEC 21140	SMC83c100	DEC 21140	DEC 21140
Buffer RAM	6K	16K	4K receive FIFO, 2K transmit FIFO	4K receive FIFO, 2K transmit FIFO	4K receive FIFO, 2K transmit FIFO	2K receive FIFO, 2K transmit FIFO	4K receive FIFO, 2K transmit FIFO
Performance enhancement technique	Dynamic chaining	Dynamic chaining	Fastracc	SimulTasking	SimulTasking	Capture effect avoidance	None
Remote boot PROM support	■	■	■	■	■	■	■
Flash ROM on-board	■	■	■	■	■	■	■
DMI compliant	■	■	■	■	■	■	■
Network and board diagnostics	■	■	■	■	■	■	■
SNMP agent	■	■	■	■	■	■	■
Driver Support							
NetWare 3.x/4.x server	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Novell ODI Client DOS	■	■	■	■	■	■	■
Novell ODI Client OS/2	■	■	Optional	■	■	■	■
Latest NDIS version number	3.0	3.0	3.0	3.0	3.0	3.0	3.0
DEC PathWorks	■	■	■	■	■	■	■
IBM OS/2	■	■	■	■	■	■	■
IBM OS/2 LAN server	■	■	■	■	■	■	■
LANtastic	■	■	■	■	■	■	■
Macintosh System 7.5x	■	■	■	■	■	■	■
Microsoft LAN Manager	■ (via BBS)	■ (via BBS)	■	■ (via OS)	■ (via OS)	■	■
Microsoft Windows 95	■	■	■	■	■	■	■
Microsoft Windows for Workgroups (NDIS 3.0)	■	■	■	■	■	■	■
Microsoft Windows NT 3.5x	■	■	■	■	■	■	■
NetWare Lite	■	■	■	■	■	■	■
Sun Solaris X86	■	■	■	■	■	■	■
SunSoft PC/NFS	■	■	■	■	■	■	■
UnixWare 2.x	■	■	■	■	■	■	■
VINES Client/Server 6.0	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
FTP TCP/IP or NCSA TCP/IP packet drivers	■ ■	■ ■	■ ■	■ (via BBS) ■ (via BBS)	■ (via BBS) ■ (via BBS)	■ ■	■ ■
Technical Support							
Warranty	Lifetime	Lifetime	3 years	Lifetime	Lifetime	2 years	Lifetime (parts only)
Free technical support (eastern time)	10:00-8:00 M-F	10:00-8:00 M-F	11:00-8:00 M-F	8:30-8:00 M-F	8:30-8:00 M-F	11:00-8:00 M-F	8:00-8:00 M-F
Toll-free telephone number	None	None	800-262-2290	800-992-4762	800-992-4762	None	None

N/A—Not applicable. The product does not have this feature * For Macintosh clients only.

numerous potential frustrations of installing LAN adapters. In addition, the cards have line-speed auto-sensing for easy upgrading from a 10-Mbps network to a 100-Mbps network, although to install for 10-Mbps Ethernet you must add a line to clients' NET.CFG files.

The PCI version turned in solid performance results on our tests: The EtherPower (\$159 street) delivered a middle-of-the-pack 63.5 Mbps on the client version of our NIC Throughput test with 32K blocks. It scored well on the Performance/Efficiency Index, placing sixth, and performed above the average on the server version of the NIC Throughput test. On the other hand, SMC's Ether 10/100 EISA card (\$255 street) finished last on virtually every test with very poor CPU utilization, bested by the other two EISA cards we reviewed.

For the most part, the EZStart installer does the job it promises, and helps to set SMC apart from the cards in our roundup that included no installer utility. The EZStart installer will even install a Simple Network Management Protocol (SNMP) agent, giving you the option to gather statistics about the card if you choose. In our testing, though, it took us two tries to get the EZStart program to install the proper driver and configure the computer's system files.

SMC comes with a standard group of drivers, including Novell ODI DOS client, NetWare server, and NDIS 2.1 (but not NDIS 3.0). The EtherPower PCI adapter also installed easily under Windows 95, which recognized the card and installed the generic driver for the Digital chip set.

The SMC EtherPower 10/100 is a solid choice for both clients and servers, but skip the Ether 10/100.—*GM*

SMC EtherPower 10/100. List price: \$169.
SMC Ether 10/100. List price: \$269. *Standard Microsystems Corp., 80 Arkay Dr., Hauppauge, NY 11788; 800-762-4968, 516-435-6255; fax, 516-273-1803; Web, <http://www.smc.com>.*

Circle 451 on reader service card

SysKonnect Inc.

SysKnect SK-NET Flash 10/100 PCI

On our benchmark tests, the SysKonnect SK-NET Flash 10/100 PCI (\$215 street) performed admirably, scoring in the top five on the client version of our NIC Throughput test with 32K blocks and delivering 89 Mbps with 32K blocks on the server version of our NIC Throughput test. However, on the Performance/Efficiency Index it had one of the bottom five scores, making it a poor choice for a server NIC.

The SK-NET Flash 10/100 PCI has a line-speed auto-sensing feature, so changing from 10 to 100 Mbps involves no hardware or software changes. As with some other NICs we looked at, the board and the

driver automatically determine the line speeds.

The installation was somewhat disappointing; the SK-NET Flash does not include a setup utility, but does come with a diagnostic utility that will tell you whether the card is functioning properly. As with some other cards, installing drivers for the SK-NET Flash is a completely manual affair, and driver installation and patch update instructions under various operating systems are included in text README files.

The card includes a good collection of drivers, and the 70-page manual comes complete with troubleshooting tips and well-drawn installation diagrams. What's unusual about the manual is that it provides very detailed steps and illustrations for installing the card in a PC—more than adequate for any beginner. Unfortunately, despite the appearance of the manual, the lack of an installation utility makes this card an unlikely choice for neophytes.—*GM*

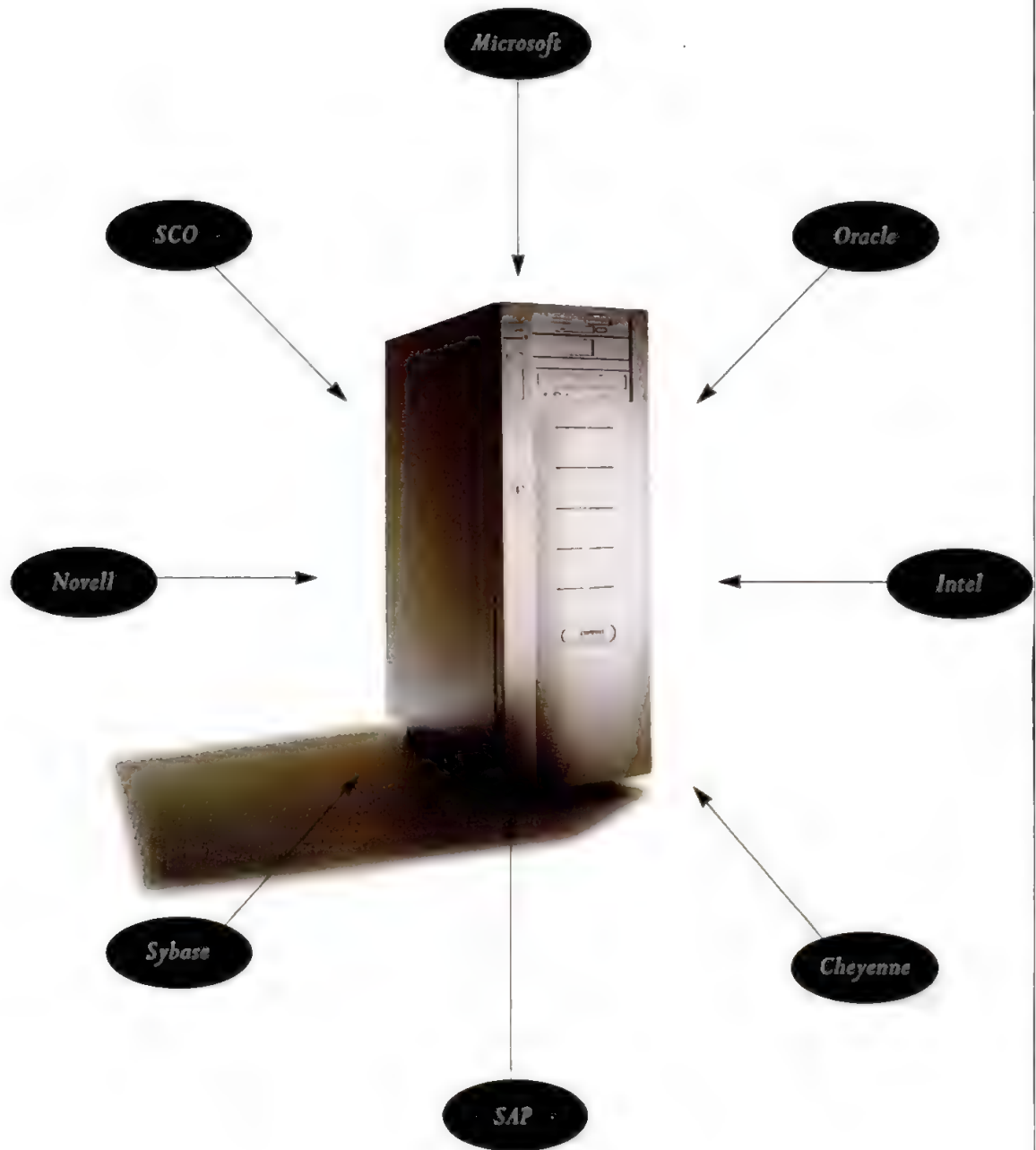
SysKonnnect SK-NET Flash 10/100 PCI.
List price: \$259. SysKonnnect Inc., 1922
Zanker Rd., San Jose, CA 95112; 800-752-
3334, 408-437-3800; fax, 408-437-3866; e-
mail, info@syskonnnect.com.

Circle 452 on reader service card

[illegible]

SERVICES *are* BUILT *by* TEAMS *of* PEOPLE

SOLUTIONS



TIONS *are* BUILT *by* TEAMS *of* COMPANIES.

Any computer company can build hardware that runs software that runs your business. Or can it? After all, this is your business we're talking about here. Do you really want to trust it to mere hardware? At Compaq, we're betting you'd prefer an easy-to-use, fully thought-out solution. A solution that is the right combination of server, operating system, and database application that solves the puzzle of your varied computing needs.

Well, that takes several companies. Companies like Microsoft, with whom we created the ideal platform for Windows NT and BackOffice, integrating hardware, software, and server management. Novell, with whom we've created networking standards for years. Oracle, whose databases are far easier to deploy on a Compaq server thanks to our partnership. And SAP, a leader in client/server applications, who's named us Partner of the Year.

You see, they may be Compaq servers. But they are Compaq-Microsoft-Oracle-SAP-Intel-Novell-SCO-Sybase-Cheyenne solutions. (We just couldn't fit all those logos on them.)

The Compaq logo, featuring the word "COMPAQ" in a bold, italicized, sans-serif font. The letters are red with a yellow outline and a slight shadow effect.

Has It Changed Your Life Yet?

Thomas-Conrad Corp.

**Thomas-Conrad TCTX048
100Base-TX PCI Adapter**

At a street price of \$200, the Thomas-Conrad TCTX048 100Base-TX PCI Adapter is one of the slower cards we tested, with 55 Mbps on the client version of our NIC Throughput test with 32K blocks and 69.5 Mbps on the server version of the NIC Throughput test. The card does not auto-sense line speeds, and Thomas-Conrad includes no installation utilities.

The TCTX048 has a pair of RJ-45 connectors, one for 10-Mbps operation and one for 100-Mbps operation. Like some of the other cards we tested, you must switch the cabling from one connector to another when upgrading to 100 Mbps. You must also change the software configuration to switch from 10- to 100-Mbps operation and for full-duplex operation.

The adapter comes with a 10-page installation guide consisting of a feature listing, card and cabling specifications, and hardware installation guidelines. The setup disk contained additional instructions on the installation of drivers on various platforms, but no installation or diagnostic utilities are included with the card.

In addition to a somewhat limited assortment of client and server drivers—with more available from the company's BBS—the driver disk contained an SNMP agent for remote monitoring. It also contained more recent versions of the MSM and EtherTSM NLMs for NetWare—the ones that Thomas-Conrad recommends for the TCTX048 100Base-TX PCI Adapter.

Poor performance and lack of auto-sensing make the Thomas-Conrad card a poor choice.—ARD

Thomas-Conrad TCTX048 100BASE-TX PCI Adapter. List price: \$215. Thomas-Conrad Corp., 12301 Technology Rd., Austin, TX 78727; 800-332-8683, 512-433-6000; fax, 512-433-6029; Web, <http://www.tci.com>.

Circle 453 on reader service card

3Com Corp.

**3Com Fast EtherLink
10/100 PCI,
3Com Fast EtherLink
10/100 EISA**

For a fast, inexpensive client adapter with line-speed auto-sensing, the 3Com Fast EtherLink PCI 10/100 is an excellent choice. With a street price of \$135—the lowest of the products reviewed—the Fast EtherLink PCI was also the fastest on the client version of our NIC Throughput test with 32K blocks, sustaining more than 80 Mbps.

We do not recommend the 3Com PCI card as a server adapter: It had low server throughput and high CPU utilization. The 3Com Fast EtherLink 10/100 EISA also had relatively poor scores on our server tests compared with

the EISA and PCI cards we tested.

3Com boosts performance with its Parallel Tasking Processor, which sends incoming packets directly to the PC's bus without receiving an entire block. The adapters in our roundup provided only 10-Mbps full duplex; 3Com plans to add 100-Mbps full-duplex capability early next year. The Fast EtherLink adapter also offers an auto-sensing RJ-45 connector. No changes to client configurations are required to change to Fast Ethernet.

3Com includes a fairly extensive set of drivers, but we were disappointed to find that the installation and configuration utility installs only NetWare ODI client drivers; other drivers must be installed manually. Windows 95 recognized the cards and loaded 3Com's drivers. 3Com guarantees its PCI adapter will work in all PCI slots, and will automatically switch to processed I/O data transfer mode if bus mastering is unavailable.—CL

3Com Fast EtherLink 10/100 PCI. List price: \$159. **3Com Fast EtherLink 10/100 EISA.** List price: \$285. 3Com Corp., 5400 Bayfront Plaza, Santa Clara, CA 95052-

8145; 800-638-3266, 408-764-5000; fax, 408-764-5001; Web, <http://www.3com.com>.

Circle 454 on reader service card

Znyx Corp.

Znyx NetBlaster 200

On our server adapter tests, the Znyx NetBlaster 200 turned in good throughput and very good server CPU utilization (34 percent with eight clients on the test with 32K blocks) scores. Priced at \$159 (street), it also includes auto-negotiating (formerly known as NWay) to integrate Fast Ethernet products seamlessly into the network. However, the NetBlaster 200 had a comparatively lackluster performance on the client version of our NIC Throughput test, scoring below average on each of our client test runs.

The initial NetBlaster 200 cards that Znyx sent to us were prototype models with several wire jumpers soldered onto the back. The finished, shipping versions of the cards, which we later inspected and tested, were identical except that the wire jumpers were gone.

The NetBlaster 200 conforms to the Fast Ethernet auto-negotiation standard, which lets network devices identify their maximum speeds and negotiate the highest possible speed: 10 Mbps, 100 Mbps, or full-duplex transmission at either speed. This feature is more advanced than line-speed auto-sensing, and only two other adapters we reviewed included it (the AsantÉFast and Intel PRO/100B).

The card comes complete with a manual that provides installation and configuration details for five other Znyx cards besides the NetBlaster 200, but overall is straightforward and comprehensive. In addition, a quick-start guide for the NetBlaster 200 explains step-by-step installation under MS-DOS, Windows 3.1, and Windows 95—exactly the sort of thing you should be looking for when installing adapters. Znyx also includes drivers for a wide array of OSs, including NetWare ODI, NDIS 2.1 and 3.0, OS/2, OS/2 LAN Server, and NetWare server.—GM

Znyx NetBlaster 200. List price: \$189. Znyx Corp., 48501 Warm Springs Blvd., # 107, Fremont, CA 94539; 510-249-0800; fax, 510-656-2460; e-mail, sales@znyx.com.

Circle 455 on reader service card

The 3Com Fast
EtherLink PCI 10/100 is a
fast, inexpensive client
adapter with line-speed
auto-sensing.

PC Tech

THE DEFINITIVE GUIDE TO PC TECHNOLOGIES & TOOLS

Personal SQL: Enterprise Power in Miniature

Small-scale, feature-rich, low-cost databases bring SQL to PCs and portables.

By Brian Butler

PERSONAL SQL PRODUCTS AT A GLANCE

	Gupta SQLBase	Personal Oracle7	Sybase SQL Anywhere
Single-user license price	\$395	\$395	\$295
Bidirectional scrollable cursors	✓	✓	✓
Declarative referential integrity	✓	✓	✓
Triggers	✓	✓	✓
Stored procedures	✓	✓	✓
Can act as a networked SQL server	✓	✓	✓
Two-way replication	✓	✓	✓
Built-in database compression	✓	✓	✓
GUI administration tool	SQL Console	Oracle Navigator	SQL Central
Links to vendor's enterprise servers	N/A	Common code base across all platforms	Transact-SQL, Open Server gateway

N/A—Not applicable. Gupta does not offer a line of enterprise server products.

Client/server systems have always brought data closer to the people who use it. In traditional deployment scenarios, they have made it possible for large organizations to decentralize costly mainframes and minicomputers and replace or enhance them with LAN-based SQL database servers running NetWare, OS/2, Unix, and Microsoft Windows NT.

The next logical step involves bringing corporate data even closer to users by distributing it to PCs and mobile laptops. This puts data at the command of those who can benefit from it the most—remote salespeople equipped with portable computers or managers working from home, for example. Having the data closer to users also facilitates timely data entry and modification. Just as large organizations benefited by migrating of data from the mainframe down to the LAN, all organizations, big and small, will benefit further from the exchange of LAN-based data between database servers and standalone PCs or portable laptops. The core components that will make this possible are lightweight, portable,

IN THIS SECTION



TUTOR Windows 95 tips and tricks may be a dime a dozen, but some are definitely more equal than others. Jeff Prosis supplies his favorite power-user tips for customizing the environment; producing kinder, gentler long filename aliases; opening folders from the command line; and customizing the New menu. He even gives away the location of the hidden Windows 95 Easter egg. *page 247*

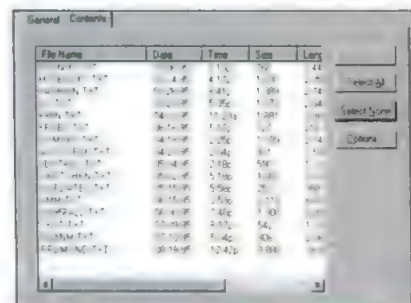


POWER PROGRAMMING John Lam takes a detailed look at OLE Structured Storage, Microsoft's now-prevalent operating system extension that standardizes access to compound files through a set of interfaces based on the Component Object Model. We also offer source code for a sample Delphi program that lets you browse structured storage files and demonstrates that not all OLE programming requires C or C++. *page 249*



UTILITIES ZipView, this issue's utility, is a shell extension for Windows 95 that lets you browse the contents of a .ZIP archive and selectively unzip its contents. Behind this easy-to-use utility are some complex programming techniques, including smart ways to use the Windows 95 ListView control. *page 255*

ALSO IN THIS ISSUE PC Solutions squashes some bugs in earlier PC Magazine batch file listings, shows you how to install DOS 6.x enhancements to Windows, solves conflicts between 32-bit file access and CD-ROMs on a single IDE bus, and provides a fix for some strange symptoms in OS/2 Warp. *page 265*



See page 255 for a free shell extension for PKZIP users.



FIGURE 1: Gupta *SQLEdit* is a helpful utility that takes much of the guesswork out of configuring the database client and server software.

yet feature-rich versions of the big SQL engines that began the client/server revolution in the first place.

During our last look at SQL database servers ("The Great Leap Forward," October 11, 1994), we reviewed SQL database products for LAN-based servers aimed at workgroup and enterprise solutions. Since then, the movement from the LAN to desktops and laptops has gathered considerable steam. Vendors have been busy adding functionality to support the unique role that personal SQL databases play by providing easier administration, data replication, and inexpensive deployment.

In this story, we look at three major 32-bit personal SQL products targeted at the Windows 95 desktop: Gupta SQLBase, Version 6.02; Oracle's Personal Oracle7, Version 7.2 for Windows 95; and Sybase's SQL Anywhere, Version 5.0. All offer a rich feature set suited to deployment on PCs and laptops. SQLBase was shipping at the time of our review, while Personal Oracle7 and SQL Anywhere were in late beta testing. Personal Oracle7 should be out by the time this story appears; SQL Anywhere is expected to ship by year's end.

GUPTA SQLBASE

Gupta SQLBase was the first SQL database designed from the ground up as a small-footprint engine for PC-based client/server computing. It also pioneered certain slick features that are particularly useful for Windows-hosted applications, such as bidirectional scrollable cursors.

Version 6.0, the first major new release of SQLBase Server in three years, has greatly extended its feature set and has addressed several of the problems we encountered in previous releases. New features include support for stored procedures, triggers, timer events, and distributed transactions, as well as enhancements to SQLBase's installation and configuration utilities. Gupta has also boosted SQLBase's database capacity (the company now claims support for databases

up to 10GB in size). SQLBase boasts a new data-load architecture that greatly improves database load times.

SYBASE SQL ANYWHERE

Over the years, SQL Anywhere's direct ancestor, Watcom SQL, has built a solid reputation for its small footprint, stability, ease of installation, and low entry price. Recently, Watcom SQL has seen some turbulent times. Watcom International was acquired by Powersoft, which in turn was acquired by Sybase. Thankfully, Sybase is taking the Watcom legacy seriously and is starting to enhance it. Sybase is currently making Watcom SQL an essential part of its overall enterprise solution by adding strong integration with the rest of the Sybase SQL Server product offerings. With the coming release (which would otherwise have been Watcom SQL, Version 5.0), Sybase has renamed the product Sybase SQL Anywhere.

Sybase SQL Anywhere will offer data replication, new database management tools, ODBC 2.0 support, and improved performance. Sybase has extended SQL Anywhere's language to support the Sybase Transact-SQL dialect, the same dialect supported by Sybase SQL Server enterprise database servers. In addition, Sybase has built an Open Server gateway for SQL Anywhere, allowing a SQL Anywhere database server to support Sybase Open client applications. Since Open Server leverages all the traditionally supported network protocols and client operating systems, SQL Anywhere will greatly increase the number of options available to the user.

PERSONAL ORACLE7

Unlike Gupta's SQLBase or Sybase's SQL Anywhere, which were designed from the ground up as desktop SQL products, Oracle7 was first built as an enterprise-level

server. Personal Oracle7, which is built on Oracle's core Oracle7 database engine, offers full Oracle7 compatibility and functionality, including referential integrity, triggers, stored procedures, and sophisticated disk management. It does, however, lack its enterprise sibling's support for distributed databases.

One sign of Personal Oracle7's enterprise heritage is its big appetite for resources. The basic installation requires at least 50MB of disk space and a recommended minimum of

8MB of RAM. We found that in practice, the program requires at least 16MB of RAM and about 75MB of disk space. SQLBase's and SQL Anywhere's requirements are trivial in comparison: Each requires only about 20MB of disk space and 8MB of RAM.

The release of Personal Oracle7 we tested (7.2) represents a significant improvement over previous Personal Oracle versions. Not only does it bring the core database technology in line with the latest versions of Oracle7 server products, but it will offer greatly improved performance and ease of administration. The previous release, Personal Oracle7 for Windows, was a Win32s application designed to run under Windows 3.1. This product suffered from significant performance constraints due to thunking between 16-bit and 32-bit APIs. Oracle is claiming a fourfold performance boost for the 7.2 release, due to its native 32-bit architecture. (Although we did not run formal performance tests, the new release server did appear to run significantly faster.)

New features in Personal Oracle7's Windows 95 version include improved administration tools, dynamic database expansion, user-specific hash functions, faster index creation, C++ support, and support for a mechanism to return multirow result sets from stored procedures. Probably the most

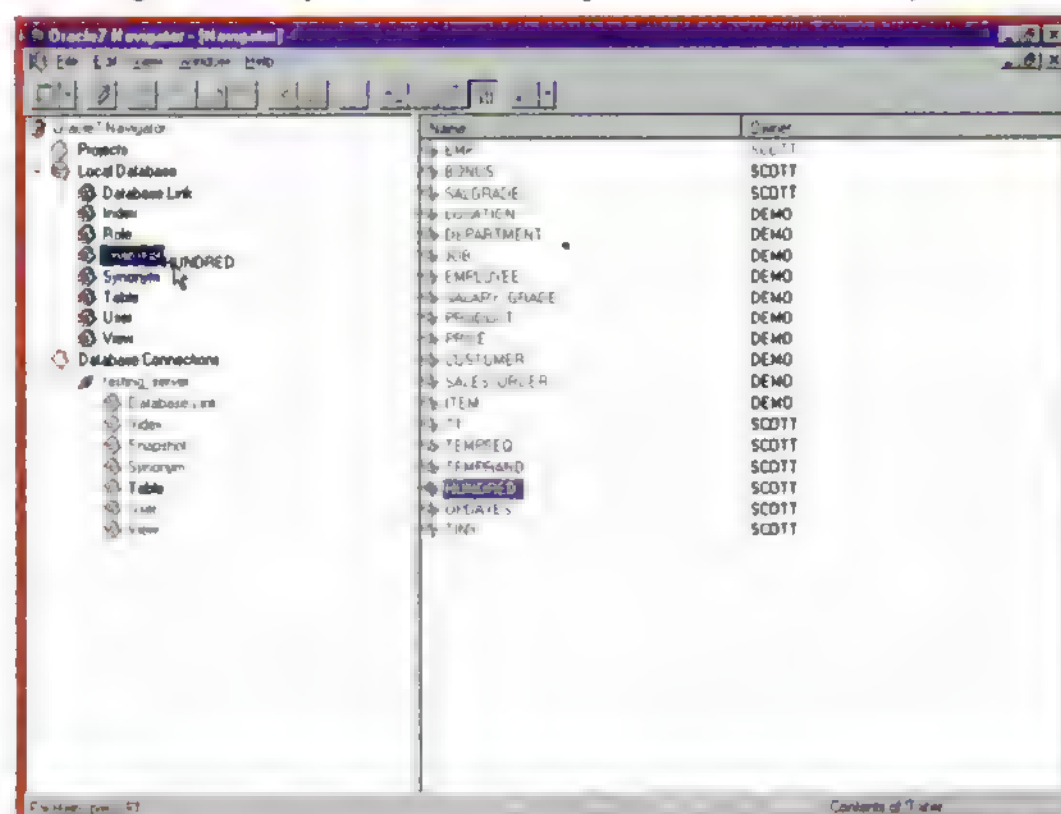


FIGURE 2: Using the Oracle7 Navigator, users can quickly replicate tables from the workgroup/enterprise database server by simply dragging them from the remote Oracle7 database into the snapshot folder.

interesting new feature is its ability to replicate data from its larger cousins, making Oracle7 the only database to support seamless replication from the desktop to the mainframe.

INSIDE THE ENGINE

Both SQL Anywhere and SQLBase allow Windows 95 to act as a server platform for other client workstations in a workgroup. Thus, in small shops a Windows 95 machine can act as

a database server (although we suggest that you run Windows NT for workgroup applications). Personal Oracle7, as its name implies, is a single-user database that does not support client connections across a network. Oracle will, however, be porting its Oracle7 Workgroup Server product to Windows 95, which will support this functionality.

The extent to which all the personal SQL products we saw incorporate advanced engine features is remarkable. For example, all support stored procedures and triggers, and all except Personal Oracle7 support bidirectional scrollable cursors. When it comes to declarative referential integrity, the three products also have their bases covered. All support restrict and cascading deletes. Personal Oracle7 is the only product that does not have a Set Null option. SQL Anywhere has extended the language with a Set Default option, letting you update a child row's foreign key reference to a value of your choice. Personal Oracle7 and SQL Anywhere both support column constraints.

Personal Oracle7, SQLBase, and SQL Anywhere all allow administrators to specify whether a trigger should fire before or after the triggering operations (INSERT, UPDATE, or DELETE). Personal Oracle7 and SQLBase both have the ability to execute stored procedures on the server at scheduled times. This is great for system maintenance tasks, such as updating statistics, or performing nightly reports.

All the products support updatable views that allow UPDATE, INSERT, and DELETE operations to be performed through a database view. But only Personal Oracle7 and SQLBase support a Check option that ensures that result insertions or updates are rows that the view query can select.

COMPRESSION

On portable computers, disk space is at a premium. For this reason, SQL Anywhere gives you both support for Windows 95 disk compression and built-in database compression. Gupta SQLBase supports Windows 95 disk compression, but lacks built-in database compression. Personal Oracle7 does not support Windows 95 disk compression for database files (application code can reside on a compressed drive, however); nor does it have built-in disk compression for database files.

SQLBase's language for stored procedures and triggers is based on the SQLWindows Application Language (SAL), which gives SQLBase close ties with Gupta SQLWindows, the company's well-known front-end develop-

ment tool. This allows a SQLWindows developer to test stored procedure code within the SQLWindows debugger before storing it on the server. (The stored procedure may require a bit of tweaking before loading in order to separate client and server code.)

SQL Anywhere is unique in that it supports

If Microsoft is so enthralled with ODBC, we wonder why it doesn't include ODBC as a standard component with Windows 95.

two distinct languages: the traditional Watcom implementation of the SQL language and Sybase's Transact-SQL. The addition of Transact-SQL heralds the integration of the Watcom-built SQL Anywhere into the Sybase product line. This will ease the migration between Watcom SQL products and Sybase database servers. In addition, Sybase will be releasing an Open Server gateway to SQL Anywhere that will allow Sybase client applications to gain access to data stored in a SQL Anywhere database. Open Server for SQL Anywhere can be run on the same machine as SQL Anywhere (although Open Server will

Replication Server and support all the client platforms that SQL Server does. SQL Anywhere does fall short in one respect, however: While the Open Server allows Sybase applications to connect to a SQL Anywhere database, it does not allow developers to develop Sybase applications easily on the Windows 95 desktop. Although SQL Anywhere understands Transact-SQL, it does not support DB-Library (Sybase's C programming interfaces). Thus, while it is possible for you to develop an application that will be portable to a Sybase Server, you'll need to use ODBC or a 4GL such as Powersoft's PowerBuilder to build it.

As Oracle has moved to deploy its core engine from the desktop all the way to the mainframe, it has had to reevaluate some elements of the engine's basic architecture. For example, the addition of dynamically expanding database files is not a big administration problem for a centralized database server, but when you are deploying hundreds of Oracle7 databases to workgroups and mobile users, it certainly becomes one. With the 7.2 release of Personal Oracle, database files can automatically expand (and in some cases contract) when space is required, reducing the need for manual intervention, easing administrative burdens, and improving availability.

WINDOWS 95: SCHIZOPHRENIC PROBLEMS

On the surface, Windows 95 looks harmless enough. Lurking underneath, though, is an operating system with two distinct subsystems: one for 16-bit applications and one

for 32-bit applications. If you're using a 16-bit development tool like PowerBuilder or Delphi, you can run into trouble—as we found out after we installed the 32-bit versions of our personal SQL database products.

The first shock is that you will need to have two versions of everything: two versions of the native database drivers, two ODBC drivers, and two ODBC administrators, one for 16-bit applications and the other for 32-bit applications. This involves configuring both subsystems separately and checking versions. Each tool also installs its own version of the ODBC administrator, which you have to version-check. (If Microsoft is so enthralled with ODBC, we wonder why it doesn't include ODBC as a

standard component with Windows 95.) We found that the vendors' native drivers were much easier to use and administer than ODBC, although we had to install both 16-bit and 32-bit driver flavors.

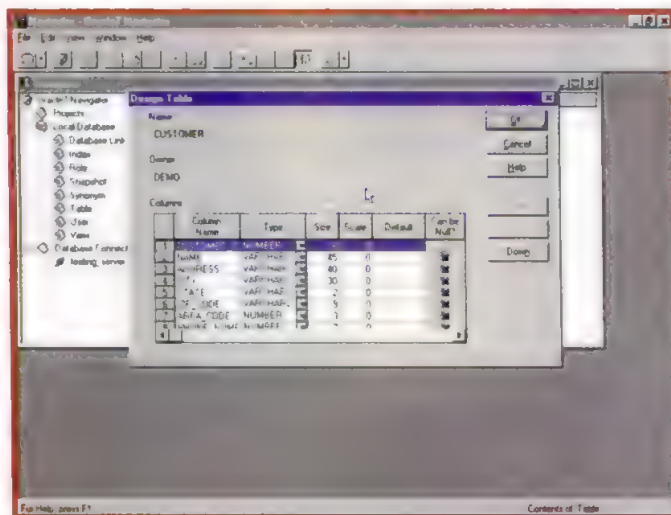


FIGURE 3: Oracle7 Navigator has the look and feel of the Windows 95 Explorer. With a click of the right mouse button, users can see properties of objects. It is not, however, as complete as Sybase SQL Central.

not be available for Windows 95).

SQL Anywhere bests SQLBase with its upward scalability into the enterprise. Through the use of the Open Server gateway, SQL Anywhere is able to participate in the Sybase



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SYSTEM REQUIREMENTS: A PC equipped with a 386, 486, Pentium or equivalent processor. Windows 3.1 or 3.11; Windows for Workgroups 3.1 or 3.11 running in 386 enhanced mode. 4 MB RAM required, 8 MB RAM recommended. RAM Doubl for Windows works in tandem with any DOS memory extension, such as QEMM or Novem. © 1995 Connectix Corporation. 2655 Campus Drive, San Mateo, CA 94403 USA. 800-819-3628 • 415-571-5100 • FAX: 415-571-5195. RAM Doubl is a trademark of Connectix Corporation.

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- Top Right:** Caption: "Grow a third head (turkey)." Illustration: A man's face with a second head growing from his forehead, displaying numbers like 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.
- Middle Left:** Caption: "Lose a year of your life." Illustration: A hand holding a small, crumpled piece of paper against a bright orange background.
- Middle Right:** Caption: "Read an entire magazine." Illustration: A large, detailed eye superimposed over a yellow document or book cover.
- Bottom Left:** Caption: "Manage your time." Illustration: The cover of a People magazine featuring a couple, with headlines like "HE NEVER LOVED HER" and "Charles' shocking confession..."
- Bottom Right:** Caption: "Now Up-to-Date." Illustration: A CD-ROM case for "Now Up-to-Date" software, showing a clock icon and a checkmark.

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 4. **Results**
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 217. **Figure 208**

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Gupta's and Oracle's ability to allow the same configuration file to be shared between 16-bit and 32-bit clients made administration of connectivity software somewhat easier. We found that Gupta's useful SQLEdit utility greatly enhanced the ease of configuring the SQL.INI file (see Figure 1). SQLEdit supports editing of all supported platforms in a single utility, and all of Gupta's products use the same SQL.INI file.

Personal Oracle does not provide a utility, so we had to use a text editor to edit the file. This is a bit more complicated, but at least it was still centralized. Ironically, the older Oracle7 for Windows did have a dialog-based editor, but it was removed from the Windows 95 product.

ADMINISTRATION TOOLS

In order for personal SQL databases to be a competitive alternative to XBase databases, they have to be just as easy for non-specialists to use and maintain. This has traditionally not been the case. While the 16-bit version of Personal Oracle7 did offer some administration applets, these fell well short of masking the complexity of the Oracle engine. Even Watcom SQL, known for its ease of installation and use, lacked an administration utility to aid in the creation of users, tables, and maintenance. Gupta SQLBase, however, has included SQLConsole, a database administration tool, since Version 6.0.

The new version of Personal Oracle7 has rolled all its administration applets into one centralized GUI management utility called Oracle7 Navigator. Previous users of Personal Oracle7 will find the Navigator a welcome upgrade: It eliminates the need for repetitive logins, and provides a more intuitive interface. Just like the previous versions, Oracle7 Navigator is SQL*Net-compatible, so you can use it to administer any Oracle7 database on your network. Unfortunately, it is not as rich in features as some competing products.

Oracle7 Navigator, which somewhat resembles the Windows 95 Explorer, has a main window split into two panels (see Figure 2). The left panel displays Projects, Local Database, and Database Connections as a tree. The right panel displays the specific objects contained in the selected container. Right-mouse-button support is provided throughout, letting you quickly create and delete objects or view their properties. Drag-and-drop is supported, although it is only applicable to the creation of a table snapshot (a replicated table).

Database objects supported by Oracle7 Navigator are Database Links, Indexes, Roles

(Groups), Synonyms, Tables, Users, and Views. Using Navigator, we were able to create users and tables and assign rights in a matter of minutes (see Figure 3). But we found the tool lacked the ability to create SQL scripts, constraints, declarative referential integrity, stored procedures, and triggers, and it does not perform import/export operations. While import/export facilities are planned for the release, they will support only native Oracle dump files. For other file types, the character-mode SQL*Loader utility is provided.

Although Watcom SQL was always intended to be easy to use, previous versions lacked dedicated administration tools to ease the DBA's burden. SQL Anywhere 5.0 will fill this

Available wizards include database creation and backup, database compression, log translation, and database unloading (see Figure 5).

The current version of Gupta's SQLConsole is a 16-bit application that lacks the Windows 95 look and feel of the Oracle and Sybase tools (see Figure 6). We found SQLConsole to be full-featured, with the functionality required to maintain and centrally manage both local and distributed databases. SQLConsole's ability to automate typical database maintenance operations can also greatly ease administrative burdens.

SQLConsole's Object Manager uses an outline metaphor to let you create tables, referential-integrity constraints, users, indexes, views,

triggers, stored commands, and synonyms. It includes the Alarm Manager, which lets you set thresholds or conditions for a series of alarm types. When the threshold is reached, the Alarm Manager takes one of several actions, including displaying a burning newspaper icon on screen, disconnecting a user, dialing the administrator's pager, sending an e-mail message, or executing a specified SQLBase script.

SQLConsole also includes a scheduler to automate the execution of SQLBase scripts. This lets the administrator define procedures for performing regular system maintenance tasks, such as database backups. In addition, the scheduler has the ability to execute other programs at specified times.

Unfortunately, SQL Console proved to be unstable under Windows 95. We found several reproducible protection faults in this largely 16-bit application, some of which were severe enough to crash Windows 95 itself. For instance, if we started SQLBase before starting SQLConsole, we would cause a GPF every time. Working with Gupta, we determined that the database engine must be started *after* SQL Console, not before. Gupta later informed us that it did not completely test SQL Console running under Windows 95 against the local 32-bit database engine (SQL Console is aimed more at the remote administration of databases).

REPLICATION TRENDS

Today's trend toward data decentralization is helping organizations cope with a number of problems, including contention bottlenecks, skyrocketing communication costs, and massive data redundancy. But it has also created a new set of challenges, the biggest of which are maintaining data consistency and keeping data from becoming marooned on one of the many islands of information scattered

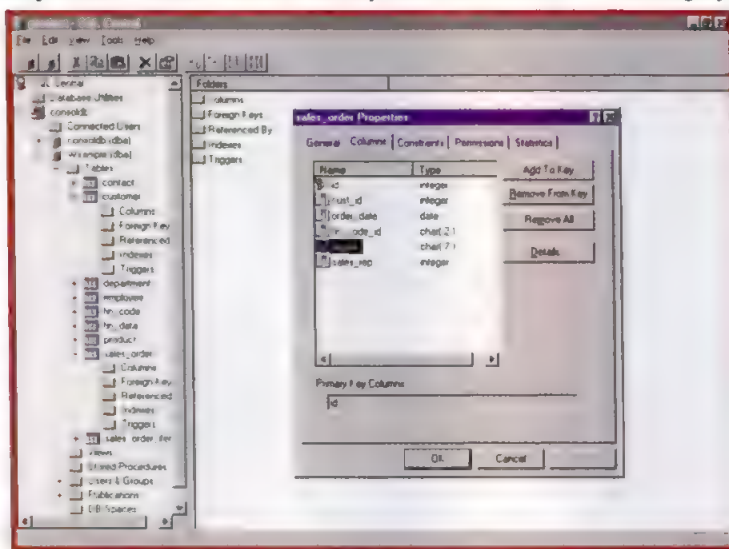


FIGURE 4: The Sybase SQL Central database administrator also has the look and feel of the Windows 95 Explorer and offers right-mouse-button support. Here, we see various properties of a table, complete with primary key, column constraints, permissions, and statistics.

gap by providing a new GUI tool, dubbed Sybase SQL Central.

Sybase SQL Central also resembles the Windows 95 Explorer (see Figure 4). Like Oracle7 Navigator, it allows the administration of multiple databases, both local and remote. Unlike Oracle7 Navigator, SQL Central includes support for creating and managing constraints, declarative referential integrity, stored procedures, triggers, and various other databases objects. We did not, however, find any bulk import/export utilities or the ability to create SQL scripts from database objects. Drag-and-drop is supported when copying columns between tables, adding users and groups, and using the text editor.

One aspect of SQL Central we found very useful was the inclusion and enhancement of the database tools used to perform routine database maintenance. In previous versions, these tools were provided as DOS command-line utilities. Sybase has now greatly eased these tasks by encapsulating them into wizards that walk you through the process step by step.

throughout the organization. What is needed are techniques for synchronizing and propagating data across the enterprise. The two-phase commit protocol and replication are the two solutions now in general use.

Traditionally, data consistency in a distributed database has been maintained by using the two-phase commit protocol. Although two-phase commit solves the problem of maintaining data consistency across multiple servers in real time, it requires tremendous overhead in both network and system resources. Distributed databases implemented using two-phase commit are also inherently fragile. Since two-phase commit requires all servers sharing in the distributed system to participate in all updates, inserts, or deletes, if one database (or network connection) is down, the whole distributed system is down. In addition, two-phase commit requires a wide network bandwidth to handle the transaction coordination. Furthermore, two-phase commit does not provide a solution for the occasionally connected user.

Replication provides an alternative. Replication is an automated process in which changes to a local database are captured and propagated to targeted, disparate databases. Replication provides a relatively easy method of distributing data to physically diverse databases, with relatively low performance impact and across low-bandwidth network connections. Replication is also more forgiving than two-phase commit, since it does not require all networks and servers to be up 24 hours a day.

Although Lotus Notes brought replication to the masses, replication did not become a popular alternative to two-phase commit for SQL databases until the introduction of the Sybase Replication Server product. Now, replication is being integrated into SQL products (and even PC database products like Microsoft Access 7.0) everywhere you look. Replication is quickly becoming the preferred method of handling distributed data solutions, particularly those for mobile users.

The Personal Oracle7 and SQL Anywhere betas we tested have added replication as a standard feature to allow seamless integration into corporate data. SQLBase does not currently support replication, although Gupta did make some details of its upcoming replication-capable product available to us.

PERSONAL REPLICATION

Version 7.2 of Personal Oracle7 will offer Symmetric Replication, the same core repli-

cation technology found on all Oracle7 platforms. This allows Oracle replication to scale from the portable computer to the mainframe. Personal Oracle7 cannot be a primary data site, only a subscriber to data.

Sybase has taken a different route in providing a scalable replication technology. By offering two distinct replication technologies, SQL Remote (the current beta's code name) and Sybase Replication Server, Sybase lets you pick the best solution for your application. Sybase Replication Server is designed for enterprise-level replication, while SQL Remote is de-

a SQL WHERE clause) and vertical partitioning (replicating only required columns). Replication partitioning is particularly important for the mobile community, where disk space is at a premium, communication transports are slow, and security is a major requirement.

REPLICATION HEADACHES

During our evaluation, we were able to set up a simple replicated database for both Personal Oracle7 and SQL Anywhere. But the experience showed us that while the end user's experience can be made straightforward, setting up

even a simple scenario is a complex, time-consuming task for administrators.

Version 7.2 of Personal Oracle7 requires a connection to an Oracle 7.2 workgroup or enterprise-level server of Version 7.2 or higher in order to perform replication. From the end user's point of view, replicating a table is a breeze. Using the Oracle7 Navigator, you simply drag-and-drop a remote database table into the Snapshot folder of your local Personal Oracle7 database. You are then prompted for the type of snapshot (read-only or updatable) and the synchronization frequency. The metadata, table definition, and data are then copied automatically. Refreshing the replicated tables is performed either automatically at specified intervals or manual-

ly through a right-mouse-button menu item.

If only life were that easy for the Oracle7 administrator! Without support from Oracle, it might have taken us weeks to configure replication. The process involved executing a SQL script to create the required tables and packages (stored procedures), a process that took our 486/66-based server one and a half hours. The next step required us to run a series of Oracle-provided SQL commands to create the system tables and packages. The entire process took us six hours to complete, including several failed attempts. Fortunately, Oracle is working on a GUI-based administration tool that may ease the task of configuring and administering replication. Until then, a difficult installation process is the price you pay for the ability Oracle gives you to deploy the same replication technology from the mainframe to the portable.

Sybase enterprise replication is every bit as involved (you are required to go to Sybase for a week of classes before setting up your solution). In addition, to integrate SQL Remote replication into a Sybase replication scenario, the administrator has to deal with two distinct replication scenarios and set up and administer four distinct servers: SQL Anywhere, an

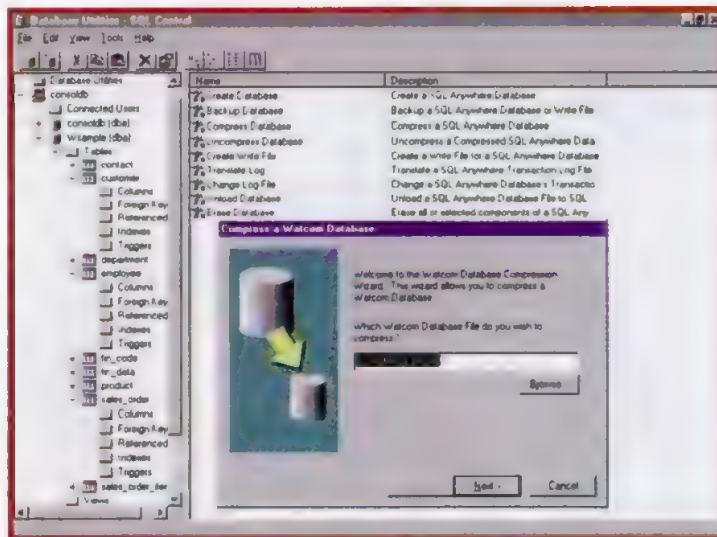


FIGURE 5: Sybase SQL Central has added Wizards to encapsulate many of the database utilities. This screen shows the initial Database Compression Wizard screen, which allows users to compress a database file.

signed for workgroup- and mobile laptop-based applications. Unlike traditional replication technologies such as those found in Personal Oracle7, SQL Remote does not require a direct connection between the primary and remote sites. Instead, it uses message protocols like MAPI to replicate data to remote sites. In addition, the new Open Server for SQL Anywhere enables SQL Anywhere to participate in enterprise-level replication scenarios.

Gupta's SQLBase replication solution will use a store-and-forward replication mechanism that will support heterogeneous databases (heterogeneous database support will not be available in the initial replication-capable release, however). Synchronization of the remote databases (subscribers) and the primary database site (managers) will be performed either through a LAN connection or through a messaging service. Heterogeneous database support will allow SQLBase to support the enterprise by leveraging replication technologies from Oracle and Sybase.

All the products will provide update-anywhere capabilities and methods to implement user-defined conflict resolution. In addition, they all provide a method of horizontal partitioning (selecting a subset of the rows by using

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Portable PCs



I needed out. My buddies in the programming lab were getting to me. So I tossed my Gateway Solo™ S120 Best Buy multimedia notebook into my pack and headed for the desert. Nothing like a little hot earth to clear the mind.

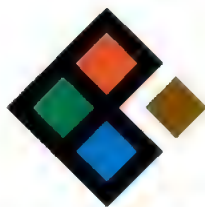
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There I was. Miles from anywhere, just working away. Thinking — *man, I love this machine!*

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Perched on a rock, jamming to my favorite tunes (thanks to the 16-bit sound stereo speakers and CD-ROM drive), I watched the moon begin its journey across the night sky.

Off in the distance I saw headlights and heard the whining of an engine begging for a tune-up. Soon a battered old truck screeched to a halt in front of me. Over the dull roar of honky-



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S O L O

tonk music I heard, "Need a lift buddy?" Sure, why not.

"My name's Ned. And this here's Chuck."

He gestured to the armadillo curled up next to him. "I'm in 'crete." 'Crete? "Yea, lots of

opportunity in concrete. Spend a lot of time on the road. But I like it that way. Say you got yourself a pretty nifty Gateway 2000® notebook.

Me too. Wouldn't make a move without Sally here," Ned smiled as he patted the



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Gateway Solo V75 notebook sitting on the dash. Sally? "That's what I call her, after a certain waitress in Tucson," Ned winked at

me. "Sally's

loaded. She

has a 75MHz

Pentium processor, 8MB RAM,

540MB hard drive, and CD-

ROM drive." He winked at me again.

Ned named his portable Sally.

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"I'm mighty fond of Gateway 2000.

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smiled Ned. "And their portable line has something for everyone."

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The radio droned on as Ned, Chuck and I continued on our trek through the dark desert.

Armadillos like to have their heads rubbed. At least Chuck did. Up ahead I saw the neon sign of a roadhouse — a beacon in the darkness.



"I could use some grub. How 'bout you?" asked Ned as he pulled the truck into the dirt parking lot.

There she stood in all her glory. Tiara and satin dress shimmering beneath the fluorescent lights. "Next tour's in 15 minutes, honey," she said. Tour? "My name's Delilah, and I give the best moonlit desert tours in the West. Is that a Gateway

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huge 10.4-inch color screen is dual-scan for extra privacy." I suppressed the urge to ask the Desert Queen about the secrets she was keeping from the world.



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believe that each system gets 24-hour, seven-day-a-week technical support? And their values just can't be beat," said Delilah with a far off look in her eyes. I had a feeling my adventures were just beginning.

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Open Server gateway for SQL Anywhere, Sybase Replication Server, and Sybase SQL Server.

With Oracle7 replication, the end user has to make some choices during the replication process. With SQL Anywhere, Sybase's goal is to have the work done entirely by the administrator. The DBA creates a remote database consisting of replicated tables from the consolidated database (typically the office database on the LAN) and gives the remote database to the end user. No extra training is required, since end users proceed as if it were just another database. The advantage of this approach is that it leaves all administrative functions for the DBA at the consolidated database site. Even conflict resolution is entirely carried out at the consolidated site.

REMOTE CONNECTIVITY

Oracle uses standard network protocols to pull the replicated data onto the laptop. Thus, when the laptop is undocked and mobile, it requires the user to use software to establish a network connection via the telephone. Windows 95 includes a built-in Remote Access Services (RAS) client, which allows the laptop user to connect easily to remote networks that support PPP or SLIP connections.

This solution provides some nice benefits. Since users have established a network connection, they can also grab network files they forgot or run other network-based programs such as e-mail applications. The downside is that this typically requires performing several steps, so that extra training of mobile staff may be necessary. It also requires the presence of a communication server in the central office.

Administrators should also keep in mind that RAS does not automatically disconnect. End users will typically stay on-line longer than necessary when replicating, racking up quite a phone bill in the process. While some PPP/SLIP servers are capable of hanging up on the user after a specified period of time, this does not always work if your network settings are set to ping the server regularly.

Gupta and Sybase have examined the downside of direct connections and taken a different route. Using standard messaging APIs like MAPI as a transport, they replicate data without a direct connection. This allows them to use standard mail programs to transfer data. This is especially nice for MAPI mail users, since IS typically has all the pieces in place for remote mail dial-in. In addition, mail systems have been designed to transfer messages quickly (both send and receive) and to hang up. Shops using Lotus Notes 3.x or CC:Mail, however, will have to invent some

workarounds, since Notes and CC:Mail do not support MAPI at this time. SQL Anywhere will not support VIM until early 1996.

LICENSING AND COST

The license policies of Gupta and Sybase are plain and simple: You buy a license for each user, no matter which operating system a person uses. Both companies ship Windows 3.x, Windows 95, OS/2, and Windows NT versions on a single CD. This increases the administrator's distribution options and lets

quickly these formerly leading-edge technologies have become commodities. Clearly, the war for the 32-bit PC SQL desktop (and laptop) will not be won here. Far more important are ease of use, intuitive administration tools, connectivity, seamless scalability, powerful replication, and integration with heterogeneous environments. These are the next battlegrounds for personal SQL.

Personal Oracle7 for Windows 95 will offer the attractions of seamless scalability from the desktop to the largest mainframe,

although its heavy resource requirements are a penalty. While it offers a rich database development environment, price may become an issue if you deploy it to large numbers of users. Despite these drawbacks, Personal Oracle7 does arguably beat the Sybase solution as a development platform—at least for now. Because of Oracle's common database technology, you can develop and deploy on any of the Oracle platforms.

SQL Anywhere does not yet have this advantage, since it depends on middleware to support DB-Library and Net-Library. But the introduction of Transact-SQL and the Open Server gateway bring SQL Anywhere several steps

closer to the goal. Its SQL Remote replication technology allows a method of replication built to suit nontechnical users of mobile laptops.

SQLBase is an apt solution for small shops and especially for SQLWindows developers, where enterprise scalability is not an important consideration. While it only scales as high as Windows NT or NetWare, this should be enough to support hundreds of users. □

Gupta SQLBase, Version 6.02. List price: \$395 (single-user license). Gupta Corp., Menlo Park, CA, 800-444-8782.

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Personal Oracle7, Version 7.2 for Windows 95. List price: \$395 (single-user license). Oracle Corp., Redwood Shores, CA, 800-672-2531.

Circle 491 on reader service card

SQL Anywhere, Version 5.0. List price: \$295 (single-user license). Sybase Inc., Waterloo, Ontario, Canada, 800-265-4555.

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Brian Butler, a contributing editor of PC Magazine, is the president of Client/Server Solutions, a St. Louis-based firm specializing in SQL database performance testing and application development. He is the chief architect of PC Magazine's SQL database performance tests.

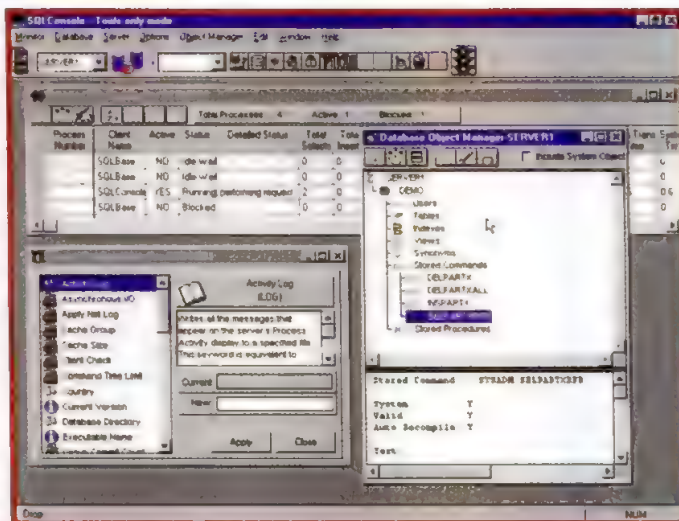


FIGURE 6: Gupta's SQLConsole lets the DBA administer, monitor, and tune both local and remote databases. Here we can see the current process statistics of a remote database server.

users migrate between operating systems without having to acquire new software and licenses. This should be especially useful for shops experimenting with Windows 95. Oracle's pricing policy is not as flexible, as the versions for each operating system have different licensing arrangements.

SQLBase and Personal Oracle7 are both initially priced the same, at \$395 for a single copy. Gupta has group discounts for large installations; these drop the price to about \$140 per copy for 50 users. Oracle has no standard group pricing, so you'll need to contact an Oracle representative for specifics.

SQL Anywhere is the least expensive of the trio, starting at \$295 for a single user and dropping to about \$100 per copy for 30 or more users. For developers wanting to deploy applications to a large audience, Sybase also provides a \$99 single-user, royalty-free, runtime version of the engine. This is a fully functional database, although you're restricted to a frozen schema: You can't add tables or other database objects.

DRAWING CONCLUSIONS

From triggers to declarative referential integrity, it is remarkable how advanced the basic engine features of these personal SQL products really are. It's also remarkable how

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By Jeff Prorise

Windows 95 Secrets

A few tricks you won't find just anywhere.

Now that you've been using Microsoft Windows 95 for a while, how well do you *really* know it? If you're like me, you learn something new every time you sit down with it. Only recently, for example, did I discover that I could drop a file icon onto a DOS window and the filename would magically appear at the command prompt. It's hard—no, impossible—to know everything there is to know about this operating system. With 10 million lines of code at work behind the scenes Windows 95 will be yielding secrets for years to come.

Windows 95 tips and tricks are a dime a dozen, but I've put together a short list of some of my favorites that you're unlikely to find elsewhere. Most of this stuff is either obscure or undocumented, so even the gurus among you should find the reading worthwhile.

EDITING THE DOCUMENTS LIST

The Start menu contains a Documents item that lists the documents you've edited most recently. Documents edited with 16-bit Windows apps are not added to this list unless they are opened through the shell, but documents edited with Windows 95 apps such as Microsoft Word for Windows 7.0 and Excel 7.0 are added regardless of how they're opened. As you upgrade more of your old 16-bit apps to Windows 95 versions, you'll find the MRU (most recently used) documents list increasingly useful.

In practice, I find that the list grows too cluttered too quickly. Usually about one third of items are documents that I might want to edit again; the remaining two thirds do little more than occupy space and make it harder to find the documents I need. You can clear the list by clicking the Clear button on the Start Menu Programs page of the Taskbar's property sheet, but it's an all-or-nothing proposition. You can delete all the items or you can delete none; there isn't an option for editing the list and removing certain items while leaving others intact.

This is where an understand-

ing of the plumbing underneath the Windows 95 shell can pay off. The shell stores the MRU documents list in the \Windows\Recent folder. Each item in the list is represented by a .lnk file (a shortcut), and deleting a .lnk file deletes the corresponding document name from the list. If there are certain documents you'd like to remove from the list, just open a window to the \Windows\Recent folder by double-clicking on My Computer and working your way down the directory tree. Then delete the shortcuts to those documents. If you do this often, save yourself some time by creating a shortcut to \Windows\Recent on the desktop and naming it Document List Editor. Then, whenever you want to edit the Documents menu, just double-click the Document List Editor icon. Creating a shortcut to a folder is simple: just drag the folder icon to the desktop with the right mouse button and select Create Shortcut(s) Here from the context menu that pops up when the mouse button is released. To rename the shortcut, right-click it and select Rename from the context menu. Or better yet, highlight the icon by clicking it, and then click the title underneath it. A small cursor will appear, allowing you to edit the title in place.

MODIFYING THE SEND TO MENU

The Send To menu displayed in context menus that appear when you right-click on a file can be modified by manipulating the con-

tents of a folder, too. The items in the Send To menu are actually .lnk files stored in the \Windows\Send To folder. You can remove items from the menu by deleting items in the folder, and you can add menu items by adding shortcuts to the folder. Send To shortcuts are easily created by right-clicking in the Send To folder and selecting New | Shortcut, or by dragging the object that the shortcut references from its home folder to the Send To folder.

One application for this knowledge is to create shortcuts for the various printers available to you and place them in the Send To folder so they will appear in the Send To menu. This way, you can print a document on a nondefault printer from a context menu. Another possibility is to place shortcuts for shared network directories in the Send To folder so that you can easily dispatch documents to network file servers.

The Send To and Documents menus aren't the only ones whose contents are stored in directories on your hard disk. Drag a program shortcut to the \Windows\Start Menu folder, for example, and the corresponding program will appear in the Start menu. Drag a folder shortcut instead and the folder's name will appear in the Start menu with a right-arrow next to it; when clicked, this displays a submenu with the folder's contents. Many users find it easier to edit the Start menu this way than by using the options found on the Start Menu Programs page of the Taskbar's property sheet.

KINDER, GENTLER FILENAMES

I don't know about you, but I don't find the 8.3 filenames such as FY95BU~1.XLS and

FY95BU~2.XLS that the system generates from long filenames very helpful. They're hard to type, and even harder to remember. Windows 95's designers refer to the tildes and numbers at the end of these filenames as *numeric tails*. The designers built in an alternative in case you, too, find that numeric tails leave something to be desired.

Here's how you can exercise that alternative: Select Run from the Start menu and type "regedit" without the quotation marks to start the Registry Editor, also known as RegEdit. Expand the HKEY_LOCAL_MACHINE branch of the registry until you find

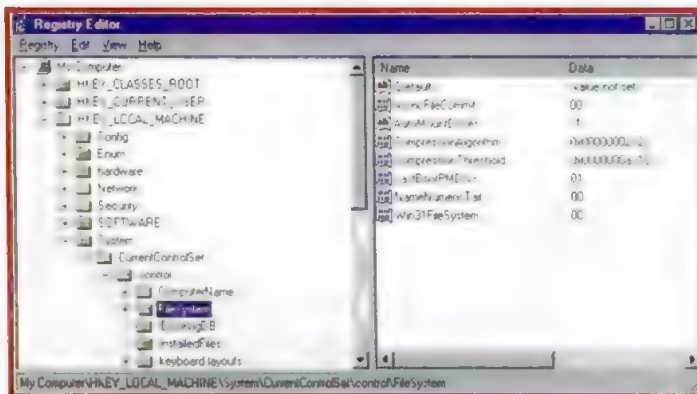


FIGURE 1: Using RegEdit to add a NameNumericTail=0 value to the registry's KEY_LOCAL_MACHINE\System\CurrentControlSet\Control\FileSystem key, as shown here, changes the way the system generates 8.3 filename aliases. FY95 Budget (Quarter1).xls, for example, is shortened to FY95BUDG.XLS instead of Y95BU~1.XLS.



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HKEY_LOCAL_MACHINE\System\Current-
ControlSet\Control\FileSystem

and click on FileSystem in RegEdit's left window pane. In the right pane you'll see a list of values assigned to the FileSystem key. Now select New | Binary Value from the Edit menu, type "NameNumericTail" (without quotation marks) and press Enter. Then double-click NameNumericTail and enter a value of 0. NameNumericTail should now show up in the right pane with a 0 value, as shown in Figure 1. Restart Windows 95, and next time you create a file named FY95 Budget (Quarter 1).xls, the short name will be FY95BUDG.XLS instead of FY95BU~1.XLS. The system will still resort to numeric tails to avoid duplicate filenames, but as long as you steer away from long filenames whose first several characters are identical, you can avoid numeric tails.

INSTANT GUI FROM A DOS WINDOW

It doesn't take most Windows 95 users long to find out they can start Windows apps from the command prompt in a DOS window. Most learn pretty quickly that documents and folders can be opened from the command line, too. For example, the command

```
start davinci.bmp
```

starts Paint and loads DAVINCL.BMP for editing. And the command

```
start \documents\bmpfiles
```

opens an Explorer window that shows all the contents of the \DOCUMENTS\BMPFILES subdirectory.

The fact that you can open a folder from the command line makes possible an interesting little trick. Suppose you're working in a DOS window and want to delete 10 or 20 files. Rather than execute 10 or 20 different DEL commands, type

```
start .
```

to open a window on the current directory. Then drag a selection rectangle around the files you wish to delete or select them one by one with the Ctrl key held down, and press Del to delete them all in one fell swoop. It's like having a point-and-shoot directory manager that you can pop up on demand. And it's a lot easier than dealing with each file individually at a command prompt.

CUSTOMIZING THE NEW MENU

Windows 95 uses file associations to associate document types, which are identified by file-name extension, with applications. If you open a .BMP file, the shell knows to start the Paint applet that comes with Windows 95 because of a file association tucked away in the

registry that correlates .BMP files to PBRUSH.EXE. In addition, the shell allows you to create new documents by right-clicking over the desktop or inside a folder window, selecting New from the context menu, and selecting the document type from the New menu. Not all document types show up in the menu, so if you use an XyzMaker application that creates .XYZ files, you may not see .XYZ files in the New menu even though a file association exists for them.

You can add .XYZ document types to the New menu by following this simple procedure. First, if a file association for .XYZ files does not already exist, create one. You can create new file associations by opening My Computer, selecting View | Options, and clicking the New Type button on the property sheet's File Types page. Once the file association is in place, create an empty document with XyzMaker and place it in the hidden \Windows\ShellNew directory. Then start RegEdit and expand HKEY_CLASSES_ROOT. Scroll down to a key named .xyz and use RegEdit to add a new subkey to .xyz named ShellNew. Click ShellNew and add a string value named FileName whose value equals the name of the empty document file in \Windows\ShellNew. Close RegEdit, and .XYZ files should now show up in the New menu.

THE EASTER EGG

Last but not least is the Windows 95 credit screen. It's fashionable these days for programmers to hide splash screens, animations, and even multimedia productions in their code, giving credit to the men and women who put in long hours developing the product. Since these presentations are usually quite colorful, they've become known as *Easter eggs*. If you know the secret key, you can unlock the door to Windows 95's Easter egg for a display of some famous (and not-so-famous) names.

To experience this "feature," follow these directions:

1. Right-click the desktop and create a new folder by selecting New | Folder. Name the folder "and now, the moment you've all been waiting for" (without the quotation marks). Hit Enter.
2. Right-click the folder, select Rename, and rename the folder "we proudly present for your viewing pleasure". Hit Enter.
3. Rename the folder again to "The Microsoft Windows 95 Product Team!" Don't forget the exclamation point at the end. Hit Enter.
4. Double-click the folder with the left mouse button.

Now sit back and enjoy the fun. The entire presentation takes about 15 minutes and then repeats until you shut it down. □

Jeff Prosis is a contributing editor of PC Magazine.



PC Tech/Power Programming

By John Lam

OLE Structured Storage: A View from Delphi

How programs communicate with and store objects from other OLE apps.

As we move boldly into the world of Windows 95 and 32-bit applications, OLE (Object Linking and Embedding) is becoming the key technology around which many great Windows applications are built. In fact, if you want to display the Windows 95 logo in your application, it must support OLE functionality. So what exactly is OLE functionality? There are two faces to OLE: one that the user sees and another that the application developer sees.

Users see OLE as the technology that enables them to share information between different applications. Users can create documents assembled from various pieces of information created by other OLE-compliant applications. They can seamlessly transfer information between OLE-compliant applications by using OLE drag-and-drop. Finally, in-place editing allows users to edit these embedded pieces of information without leaving the application they're currently working in (see Figure 1). The end result of these technologies is a paradigm shift from an application-centric view of our work toward a document-centric view of our work.

The developer sees OLE technology as a solution to a number of difficult problems. One of the most difficult problems that Windows developers face is making applications communicate with each other. In the past, there was a lack of industry-wide standards, so developers had to use the equivalent of a secret handshake; if you didn't know the handshake, you couldn't join the party. What OLE has done is to standardize that handshake. As long as you know how to say hello and can answer a few basic questions about yourself, you're in.

Another difficult problem that developers face when writing applications is how to store an application's data to permanent storage. In the past, developers only needed to develop a custom file format that would store the data specific to their application. In today's software environment, where users expect to be able to embed data created by one application into any other application, the challenge becomes much more difficult for developers. They would now have to write large amounts of code to manage difficult tasks such as

adding objects to their application's file, expanding objects already in the file, and deleting objects from the file. The OLE development team at Microsoft devised a solution to this problem by creating an operating system extension that standardizes access to compound files through a common set of interfaces. This operating system extension, known as OLE Structured Storage (SS), will be the focus of this article. After looking at the Component Object Model (COM) and how it relates to structured storage, we'll use Borland Delphi to build a sample application that browses SS files.

OLE STRUCTURED STORAGE

What features does OLE Structured Storage make available to the user? One of the most useful features is the Summary Info dialog box, shown in Figure 2. Not only can users manipulate this data in the application that created the document, but they can also search for documents by using any application that can search for summary information. This feature is extensively used throughout

the Microsoft Office line of applications, under the Find File... menu option.

How about the developer's perspective? By now you have probably guessed that the summary information is stored inside an SS file. For a better understanding of how to access the summary information data, let's first take a look at how information is organized inside an SS file.

Put simply, an SS file is "a file system in a file." From using DOS, most PC programmers have a firm grasp of what directories and files are. In OLE nomenclature, *storages* and *streams* are the terms used in place of *directories* and *files*. In an MS-DOS volume, there is a root directory. The analogous structure in an SS file is the root storage. We manipulate SS storages and streams using their respective interfaces and, in turn, the member functions of those interfaces. Figure 3 draws parallels between SS interfaces and the equivalent DOS functions. But what exactly is an *interface*? To understand this, we must dig a bit deeper into OLE and briefly discuss the Component Object Model.

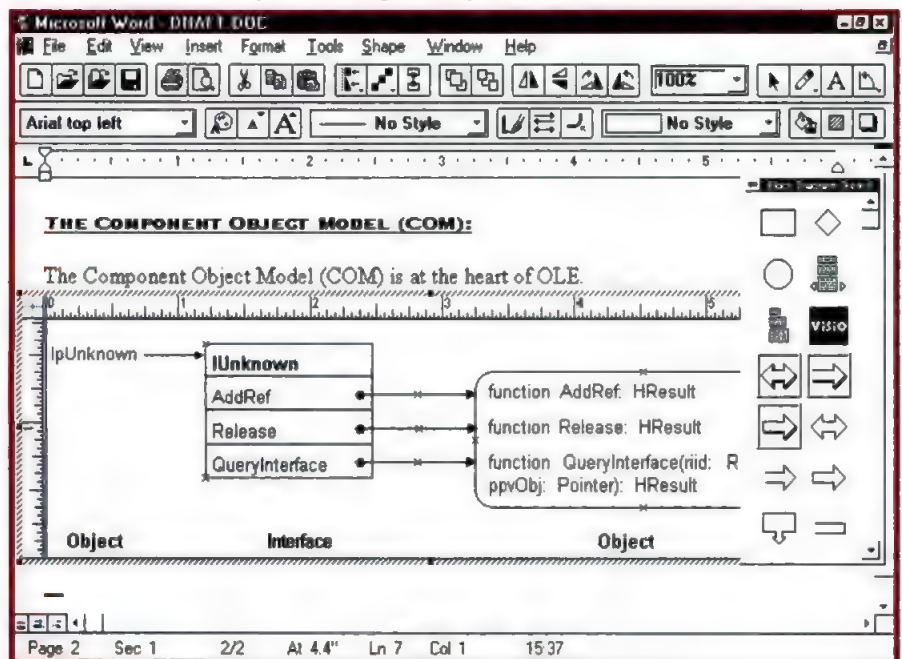


FIGURE 1: The user's view of an embedded Visio object in Microsoft Word 6.0.

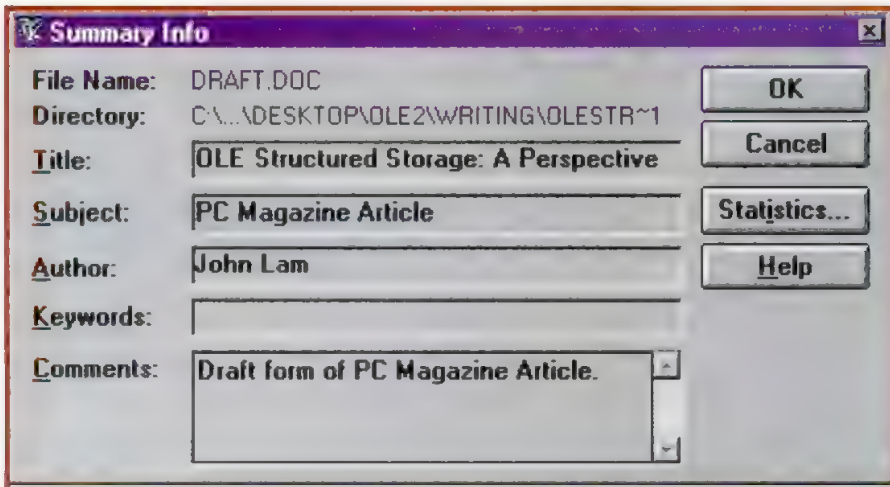


FIGURE 2: The Summary Info dialog box displays data stored in OLE Structured Storage.

THE COMPONENT OBJECT MODEL

The Component Object Model is at the heart of OLE and defines a standard way for objects to communicate with each other. It introduces the concept of an *interface*, which is simply a collection of related functions that serve a common purpose. Any object that imple-

face classes as *abstract* classes, composed only of pure virtual functions. An abstract class is never meant to be instantiated; it simply serves as a common ancestor for derived classes.

Most books on OLE programming typically use C/C++ as the language of choice. However, there is no reason why C++ is the only language that can be used to create OLE applications. Any language that supports the notion of pointers can be used to write OLE applications (this excludes p-code languages such as Visual Basic, which can only be used to control other OLE applications). Fortunately, the

Object Pascal compiler in Delphi generates v-tables that are identical to those generated by C++ compilers. Thus, Delphi can easily be used to write OLE applications, and the focus of our article will be on using Object Pascal to access OLE interfaces, although this material is quite easily transferable to C++.

ments at least one OLE interface—IUnknown—is referred to as a Windows Object (referred to hereafter simply as an *object*). An object can communicate with another object by first obtaining a pointer to an interface that's implemented by the target object.

As Figure 4 shows, an interface is just a table of pointers to functions. Therefore, by using pointer offsets into the interface table, a client object can obtain the runtime address of the functions of the server object. Manipulating pointer offsets, however, is a cumbersome method of obtaining the address of a target object's member functions. Fortunately, the structure of a COM interface is identical to that of a C++ v-table.

C++ v-tables are used to determine the address of a function at runtime, in a process known as *late binding*. If we are interested only in talking to a target object and are not implementing any interfaces of our own, we never need to instantiate an interface object. Therefore, it is appropriate to define the inter-

There is a problem with using Delphi to create OLE applications. Keep in mind that OLE is simply a binary specification created by Microsoft to define the behavior of Windows Objects. Since C++ is the most widely used object-oriented language, the OLE binary specification is defined in the OLE 2.01 SDK in the form of C++ header files. In this regard, I have both good news and bad news to report. The good news is that Borland has ported and combined many OLE 2.01 SDK C++ header files into two Turbo Pascal Unit files: OLE2.PAS and DISPATCH.PAS. The bad news is that Borland made some mistakes during the port. The first patch to Delphi 1.0 released by Borland did a pretty good job of fixing some of these errors, but others still remain.

IUNKNOWN: THE KEY TO OLE

I earlier defined a Windows Object as an object that implements, at the very least, the IUnknown interface. The member functions of this, the most basic of OLE interfaces, are shown in Figure 4.

An object must be able to count the number of references that other objects have to it so that it can unload itself from memory once the number of references drops to zero. This is the role of the AddRef and Release functions.

The only other member function of IUnknown is QueryInterface. This function allows you to query an object to see whether it supports any other interfaces. For example, if you want to see whether an object implemented an IPersistStorage interface (which lets the server object save its data in the client object's data file), you can use the following function to query the other object for an IPersistStorage interface:

```
function GetIPersistStorage(pUnknown:
IUnknown): IPersistStorage;
var
    hr: HRESULT;
    pPersistStorage: Pointer;
begin
    hr := pUnknown.QueryInterface(IID
    _IPersistStorage, pPersistStorage);
    if SUCCEEDED(hr) then
```

The IUnknown Interface



FIGURE 4: IUnknown is the one interface that every OLE object must implement. By using offsets into the interface's table of pointers, a client object can obtain the runtime address of the functions of the server object.

Initialization Code

```
procedure TMainForm.FormCreate(Sender: TObject);
var
  dwVer, hr: HRESULT;
begin
  m_fOleInitialized := false;
  dwVer := CoBuildVersion;

  if rmm <> HIWORD(Longint(dwVer)) then
    ShowMessage('Invalid OLE library version');
  else begin
    if FAILED(HR(CoInitialize(nil))) then
      ShowMessage('Failed OLE library initialization');
```

```
  else
    m_fOleInitialized := true;
  end;
end;
```

Termination Code

```
procedure TMainForm.FormDestroy(Sender: TObject);
begin
  if m_fOleInitialized then
    OleUninitialize;
  ...
end;
```



FIGURE 5: Here are the standard Delphi entry and exit library calls required for any OLE application.

```
Result := IPersistStorage(pPer-
  sistStorage)
else
  Result := nil;
end;
```

The variable *hr* is of the type *HRESULT*, which is a 32-bit value used by every OLE function for its return value. You can check to see whether the function succeeded by using the Delphi-defined function *SUCCEEDED*

(*hr*), which returns *TRUE* if no errors were encountered. If it's successful, *QueryInterface* returns a pointer to the *IPersistStorage* interface in the *pPersistStorage* parameter as a generic pointer, which must be type-casted into an *IPersistStorage* pointer. By using this general technique, you can obtain a pointer to any interface implemented by a given object.

The *IID_IPersistStorage* parameter in the *QueryInterface* call identifies the interface being referred to. So that all of the objects and

interfaces present on a user's system can be uniquely identified, Microsoft assigns unique 128-bit values known as Globally Unique Identifiers (GUIDs) to them. The fundamental OLE interfaces such as *IUnknown* and *IPersistStorage* all have predefined GUID-type values called Interface Identifiers (IIDs), and they are defined in either the *OLE2.PAS* or the *DISPATCH.PAS* files.

So, with a pointer to an *IUnknown* interface, you can get access to any other interface

```
procedure TMainForm.OpenItemClick(Sender: TObject);
var
  pszFilename, pszName: PChar;
  sc: SCODE;
  snbExclude: PStr;
  hr: HRESULT;
  dummyExclude: IStorage;
  pIStorage: ^IStorage;
  pMyStatStg: TMyStatStg;
  dummyULI: Comp;
begin
  if OpenFileDialog.Execute then begin

    { Try opening a structured storage document.
      Filename parsing is done in OpenFileDialog. }
    try
      pszFilename := StrAlloc(Length(OpenDialog.FileName)
+ 1); { + 1 for NULL }
      StrPCopy(pszFilename, OpenFileDialog.FileName);
      sc := GetSCode(StgIsStorageFile(pszFilename));
      if sc = STG_E_FILENOTFOUND then
        ShowMessage(OpenDialog.FileName + ' was not
found. ')
      else if sc = S_FALSE then
        ShowMessage(OpenDialog.FileName + ' is not a
valid OLE2 Structured Storage file. ')
      else if sc = S_OK then begin

        { Now actually open the file, and obtain a
          pointer to IRootStorage }
        FreeIStorageList;
        snbExclude := nil;
```

```
piRootStorage := nil;

if SUCCEEDED(HR(StgOpenStorage(pszFilename, nil,
  STGM_DIRECT or
  STGM_READWRITE or STGM_SHARE_EXCLUSIVE,
  snbExclude, Longint(nil),
  IStorage(piRootStorage))) then begin

  { Create Root of TOutline. This *ALWAYS* has an
    ItemIndex of 0 }
  Outline1.AddChild(0, 'Root Storage: ' +
  StrPas(pszFilename));

  { Code to create a list of open storages so
    that I can open them when I need to view
    their contents later }
  pszName := StrAlloc(100);
  StrCopy(pszName, 'Root Storage: ');
  StrCat(pszName, pszFilename);
  dummyULI := 0;
  pMyStatStg := TMyStatStg.Create(pszName,
  piRootStorage, 0, dummyULI);
  m_1stIStorage.Add(pMyStatStg);
  ViewStorage(1, piRootStorage);
  { call recursive outline filler }
end;
end;
finally
  StrDispose(pszFilename);
end;
end;
```



FIGURE 6: This code reads the directory structure of a Structured Storage file.

```

procedure TMainForm.ViewStorage(inID: Integer; lpStorage:
IStorage);
var
  lpEnum: IEnumStatStg;
  ss: TStatStg;
  ulCount, ldwType: Longint;
  sc: S_CODE;
  pSubStg: IStorage;
  subID: Integer;
  sType: String[12];
  hr: HRESULT;
  snbExclude: PStr;
  pMyStatStg: TMyStatStg;
begin
  snbExclude := nil;
  pSubStg := nil;
  if FAILEDHR(lpStorage.EnumElements(0, nil, 0, lpEnum))
  then
    ShowMessage('Could not get a Storage Enumerator at
    level: ' + IntToStr(inID))
  else begin
    sc := S_OK;
    while sc = S_OK do begin
      sc := GetSCode(lpEnum.Next(1, ss, ulCount));
      if (sc <> S_OK) and (sc <> S_FALSE) then begin
        ShowMessage('IEnumStatStg returned an error!
        S_CODE = ' + IntToStr(Longint(sc)));
        Exit;
      end
    end
    else
      ldwType := Longint(ss.dwType);
      case ldwType of
        STGTY_STREAM: sType := 'Stream';
        STGTY_STORAGE: sType := 'Storage';
        STGTY_LOCKBYTES: sType := 'LockBytes';
        STGTY_PROPERTY: sType := 'Property';
        else sType := '**Unknown**';
      end;
    { Add this record to the Outline Control. Note that
    ss.cbSize (the size of the stream object) is a 64
    bit integer. }
  end;
end;

```

```

if sc = S_OK then begin
  { Add this TStatStg record to the outline
  control. We need to use a helper function:
  GetLowPart to bust up the ss.cbSize 64 bit
  integer. }
  subID := Outline1.AddChild(inID,
  StrPas(ss.pwcsName) + ', Type: ' +
  sType + ', Size: ' +
  IntToStr(GetLowPart(ss.cbSize)));
  if ldwType = STGTY_STORAGE then begin

    { We're in a Storage- Recursively traverse the
    storage by calling ourself }
    hr := lpStorage.OpenStorage(ss.pwcsName, nil,
    STGM_READ or
    STGM_SHARE_EXCLUSIVE, nil, Longint(nil),
    pSubStg);
    if SUCCEEDEDHR(hr) then begin
      pMyStatStg := TMyStatStg.Create(ss.pwcsName,
      pSubStg, ss.dwType, ss.cbSize);
      m_lstIStorage.Add(pMyStatStg);
      ViewStorage(subID, pSubStg); { call ourself }
    end
    else
      ShowMessage('Failed substorage open! hr = ' +
      IntToStr(Longint(hr)));
    end
  end;
  { This wasn't a storage, so we write the
  current lpStorage into the table }
  pMyStatStg := TMyStatStg.Create(ss.pwcsName,
  lpStorage, ss.dwType, ss.cbSize);
  m_lstIStorage.Add(pMyStatStg);
end;
end;
lpEnum.Release;
lpEnum := nil;
end;

```



FIGURE 7: This code traverses the directory tree of a Structured Storage file.

using the QueryInterface function. But how do you get the initial pointer to the IUnknown interface? Furthermore, how do you access an object that hasn't been created yet? This is where two key OLE API functions, CoCreateInstance and CLSIDFromProgID, and the system Registry file REG.DAT come into the picture.

The system Registry file REG.DAT stores all of the information about the objects present on your computer. In particular, instead of using cryptic 128-bit GUID values, you can use a more human-readable representation of the object, known as a ProgID. For instance, the ProgID for the Microsoft Word 6.0 Word Basic object is simply "Word.Basic". The following code segment shows how to obtain the pointer to the IUnknown interface for the Word Basic object:

```

type
  acsID: CLSID;
  pUnk: IUnknown;
begin
  if SUCCEEDEDHR(CLSIDFromProgID
  ('Word.Basic', acsID)) then
    CoCreateInstance(acsID, nil,
    CLSCTX_SERVER, IID_IUnknown, pUnk);

```

The CLSIDFromProgID function looks up "Word.Basic" in REG.DAT and returns its associated CLSID in the acsID parameter. CoCreateInstance creates an instance of a Word.Basic object and requests an IUnknown interface pointer to be returned in pUnk. The pUnk parameter in CoCreateInstance is defined as an untyped reference in the file OLE2.PAS. Thus, we can pass any variable type, but since pUnk is really a 32-bit

pointer (or far pointer in C++ terms), and IUnknown is also a far pointer, we don't have to perform any explicit type-casting in this function.

The previous example illustrates how to obtain the initial interface pointer to an object. But since the focus of this article is Structured Storage, and SS files aren't objects, how do we obtain the pointer to the file's root IStorage interface? IStorage is a Windows Object implemented in STORAGE.DLL. As you might expect, what we need to do is to bind a filename to an IStorage object, and the API function that allows us to do this is StgOpenStorage.

Once we obtain a pointer to the IStorage interface, we can navigate the entire SS file using its member functions, which are remarkably similar to DOS functions (see Figure 3). We

can obtain the individual IStream interfaces inside each IStorage interface; these allow us to access SS streams, which are analogous to MS-DOS files.

One additional feature of SS files is their ability to support transactioning. That is, changes to a stream or storage are not actually committed to permanent storage until a commit command is executed. This allows the developer to give the user the ability to undo for free. A thorough discussion of this feature of SS files is beyond the scope of this article; refer to the excellent references listed at the end of this article for further information.

A STRUCTURED STORAGE BROWSER

To map my background discussion of SS files onto some code, I will walk you through a sample application that allows you to browse SS files. This application was written entirely in Delphi to show that Delphi can be used to write OLE applications as well as C++. One of the key advantages of Delphi is the wealth of prebuilt user interface components that come in the box. Two of these components, TOutline and TDrawGrid, form our user interface. TOutline displays an Explorer-like directory hierarchy that maps onto the storage hierarchy of the SS file. We use a TDrawGrid to allow the user to browse through the contents of a given stream in the SS file without actually having to load the stream into memory.

The OLE libraries must be initialized be-

fore we can use them. Figure 5 shows the standard entry and exit library calls required for any OLE application. Because an OLE application relies on the correct dynamic link libraries being present on the user's system, it makes an enormous amount of sense to check

A key advantage of Delphi is its wealth of prebuilt user interface components. Two of these, TOutline and TDrawGrid, form our user interface.

the version numbers of the libraries before starting.

For the OLE 2.01 libraries, rmm is defined as 23, and it must be defined as a constant in your application, since it is not defined in either OLE2.PAS or DISPATCH.PAS. I use a member variable m_fOleInitialized to flag whether the OLE libraries have been successfully initialized or not. For basic SS file access, the only OLE libraries needed are COM-POBJ.DLL and STORAGE.DLL. Once the li-

braries are initialized, we can break down the operations performed by the browser into three categories: (1) opening an SS file, (2) opening a stream in an SS file, and (3) browsing a stream in an SS file.

Once the libraries are initialized, we allow the user to browse around the file system using Delphi's TOpenDialog common dialog. Once the user has selected a file, we must use the StgIsStorage API call to ensure that what the user is trying to open is an SS file. If it is, we proceed to read in the directory structure of the SS file (Figure 6).

The directory structure is hierarchical, just like that of DOS. Therefore, we can easily traverse the directory data structure using a recursive routine. Here is an algorithm for traversing a directory tree:

```
PROCEDURE ViewStorage(storage)
WHILE there are more elements in the
current storage DO
    create a human-readable
    representation of current element
    add it to the outline control
    IF the current element is a
    storage THEN
        CALL ViewStorage(this storage)
END
```

OLE allows a program to step through the elements of an interface by using the OLE-defined *enumerator* interface. An OLE enumerator implements Next, Skip, Reset, and Clone functions. Once we have an IStorage

```
procedure TMainForm.Outline1Db1Click(Sender: TObject);
var
    pszName: PChar;
    pIStorage: IStorage;
    pIStream: IStream;
    pMyStatStg: TMyStatStg;
    aOffset, dummyLargeint: Comp;
begin
    if Outline1.SelectedItem > 0 then begin
        pMyStatStg := TMyStatStg(m_lstIStorage.Items
        [Outline1.SelectedItem-1]);
        StatusBar.Caption := 'Selected Item: ' +
        StrPas(pMyStatStg.pszName);

        { Now try and open the stream for this node, but
        first close existing stream }
        if m_pStream <> nil then
            m_pStream.Release;

        if pMyStatStg.dwType = Longint(STGTY_STREAM) then
            begin
                pIStorage := pMyStatStg.pIStorage;
                pszName := pMyStatStg.pszName;

                { If there was already a stream open, release it
                first }
```

```
if SUCCEEDEDHR(pIStorage.OpenStream(pszName, nil,
STGM_READ
or STGM_SHARE_EXCLUSIVE, 0, pIStream)) then begin

    { Setup the DrawGrid to Display this Stream }
    m_dwStreamSize := GetLowPart(pMyStatStg.cbSize);
    { set the stream size variable }
    m_pStream := pIStream;
    { save the interface pointer }
    Drawgrid1.RowCount := m_dwStreamSize div 16;
    { set the extent of the DrawGrid }
    Drawgrid1.Visible := True;

    { Seek to beginning of file }
    aOffset := 0;
    m_pStream.Seek(aOffset, Longint(STREAM_SEEK_SET),
    dummyLargeint);
end;
end
else
    Drawgrid1.Visible := False;
    { Hide Grid if not a Stream Object }
end;
end;
```

FIGURE 8: This code opens a stream in a storage.




```

procedure TMainForm.DrawGrid1DrawCell(Sender: TObject;
Col, Row: Longint;
Rect: TRect; State: TGridDrawState);
var
  TheText: string[16];
  i: Integer;
  byteArray: Array[0..15] of Byte;
  lBytesRead: Longint;
  aOffset, dummyLargeint: ULargeint;
begin
  begin
    { Calculate byte offset into stream and seek to that
      byte position }
    aOffset := Row shl 4;
    if SUCCEEDEDHR(m_pStream.Seek(aOffset,
Longint(STREAM_SEEK_SET), dummyLargeint)) then
      begin
        if SUCCEEDEDHR(m_pStream.Read(@byteArray, 16,
lBytesRead)) then begin

          { xxxxxxxx: xx xx xx xx xx xx xx xx xx xx xx xx
            xx xx xx xx  abcdefghijklmnopq }
          TheText := IntToHex(Row shl 4, 6) + ':' ;
          SetBkColor(DrawGrid1.Canvas.Handle,
GetSysColor(COLOR_WINDOW));

```

```

DrawGrid1.Canvas.TextOut(Rect.Left + 2 *
m_iCharWidth, Rect.Top, TheText);

for i := 0 to lBytesRead - 1 do begin
  TheText := IntToHex(byteArray[i], 2);
  DrawGrid1.Canvas.TextOut(Rect.Left + 10 *
m_iCharWidth + m_iCharWidth * i * 3
, Rect.Top, TheText);
end;

{ Format output string as printable characters or
  '.' if not printable }
TheText := '';
for i := 0 to lBytesRead - 1 do
  if IsCharAlphaNumeric(Char(byteArray[i])) then
    TheText := TheText + Char(byteArray[i])
  else
    TheText := TheText + '.';

  DrawGrid1.Canvas.TextOut(Rect.Left + 60 *
m_iCharWidth, Rect.Top, TheText);
end;
end;
end;
end;

```



FIGURE 9: This is the implementation of the owner-drawn grid, which draws 16 bytes at a time across DrawGrid1.

interface, we obtain a pointer to an IEnumStatStg enumerator by calling the EnumElements member function of IStorage, which returns an interface pointer to an instance of an IEnumStatStg enumerator. Using the Next member function of the interface to step through the individual elements returned by the enumerator, we obtain a "directory" of that storage.

The Next function of the IEnumStatStg interface returns a TStatStg structure that identifies whether the element is a storage or a stream and contains particulars about each storage type (such as the size of the stream and when it was created and last modified). Using the information contained in this structure, we construct a human-readable representation of the data and store it in the Outline1 control. We also save the information contained in the TStatStg structure in a record of type TMyStatStg that retains the pointer to the currently opened storage. We save this record in a Delphi TList structure represented by m_lstIStorage (Figure 7).

A user who wants to view a particular stream of an SS file can do so by double-clicking on the appropriate line of Outline1. Because the structure of m_lstIStorage mirrors that of the Outline1, we can simply use the offset returned by the SelectedItem property of Outline1 to look up the appropriate record in m_lstStorage. Once we have the pointer to the storage and the name of the stream that the user selected, we can use the OpenStream IStorage member function

to open a stream for the user to view (see Figure 8).

DrawGrid1 is a Delphi TDrawGrid owner-drawn grid control with a single column. It is particularly useful for our browser because TDrawGrid returns the Row number as a signed 32-bit integer. This means that it can hold potentially 2 billion rows, which translates into being able to view 4×16 or 64 billion byte streams. Because the TDrawGrid component displays grid cells on demand rather than storing the data it displays, the stream need not be loaded into memory. Instead, we use the Seek and Read member functions of IStream to draw the appropriate rows of DrawGrid1 when its DrawCell event fires. Figure 9 shows the implementation of the DrawCell event handler, which draws 16 bytes at a time across DrawGrid1.

REQUIRED WORKAROUNDS

Delphi has a native 64-bit data type called Comp. Since structured storage uses 64-bit integer offsets into streams, we can conveniently use Comp to maintain the stream offsets. But Delphi type-conversion functions such as IntToStr do not understand the Comp data type. Therefore, we need to extract the low-order long integer from the Comp data type, which is what the following helper function does:

```

{ Function to extract the Low
Longint from a Comp Variable }
function TMainForm.GetLowPart(X:

```

```
Comp): Longint;
```

```

begin
  Move(X, Result, 4);
end;

```

CONCLUSION

I hope this discussion has shown OLE's Structured Storage implementation to be a powerful file-management API that you can use in your applications. A rich set of file management functions are exposed in the IStorage and IStream objects implemented by STORAGE.DLL. These features allow developers to combine an application's data files into a single data file, which in turn allows users of their application to maintain data in a single file.

You can download all the files in this column from PC Magazine Online. See the sidebar "Guide to Our Utilities" for instructions.

FURTHER READING

- Bryan Waters' *Mastering OLE2* (Sybex, 1995) is a very well-written introduction to OLE. It provides a concise overview of the technology.
- Kraig Brockschmidt's *Inside OLE*, Second Edition (Microsoft Press, 1995) offers a very detailed treatment of OLE and includes a lot of useful reference material. □

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PC Tech/Utilities

By Jeff Prorise

Unzipping Files the Windows 95 Way

A shell extension shows you what's in your .ZIP files and unzips them.

If you're an active PC user, you probably deal with lots of .ZIP files. These compressed archives can make sending or downloading files over the modem less time-consuming and provide a way to save some disk space. But they also mean an additional operation. To extract compressed files from a .ZIP file archive, you probably do as I do: open a DOS window and run PKUNZIP. Or maybe you use a PKUNZIP-compatible Windows utility that does the extracting for you. No matter—either way, you're still doing things the old way by using an application as a middleman instead of interfacing with the document directly. Ideally, you could click the .ZIP file's icon and pick from a list of files contained in the archive. Then a simple button click would extract the files and deposit them in a folder.

That's exactly what this issue's featured utility, ZipView, allows you to do. ZipView is a Windows 95 property-sheet shell extension that adds a Contents page to the property sheets of .ZIP files (see Figure 1). On the Contents page, you'll find a list of all the files in the archive along with time and date stamps, file sizes, and more—in essence, the same information you see when you use PKZIP's -v command line switch to view the contents of a .ZIP file.

Want to see what's in a .ZIP file? Simple: Just right-click it, select Properties from the context menu, and click the Contents tab. To extract a file, highlight the filename and click the Extract button. You can also extract several files at once or sort the list by the criterion of your choice. ZipView uses PKUNZIP to do the actual extracting, so you don't have to worry about it becoming instantly outdated when a new version of PKUNZIP is released.

In addition to serving a useful purpose by helping adapt PKUNZIP to the Windows 95 mold, ZipView also demonstrates some important new Windows 95 programming principles, including:

- How to write property-sheet shell extensions.
- How to use Windows 95's new ListView control.
- How Win32 applications can spawn synchronous child processes.

- How to use the Registry to save and restore program settings.

You can download ZipView and its C++ source code from PC Magazine Online or you can obtain it by mail. For instructions, see the sidebar "Guide to Our Utilities."

INSTALLING AND USING ZIPVIEW

ZipView is unlike most PC Magazine utilities in that installing it is not a simple matter of copying an .EXE file to a subdirectory. ZipView is a DLL (dynamic link library) that must be registered with the operating system by adding entries to the Windows 95 Registry—a binary system database that's like the

Explorer window. The shell controls the visibility of DLLs and other special file types; ZVSetup has no say in the matter.

Once you click the OK button in the dialog box, setup will take no more than a couple of seconds. In the unlikely event that an error occurs, ZVSetup will display an error message telling you what went wrong. "Setup failed trying to create a registration file" means that ZVSetup was unable to create the temporary file it uses to store Registry information. Usually this means that the drive on which Windows is installed is full. "Setup failed because REGEDIT.EXE could not be found on your PC" means the RegEdit utility provided with Windows 95 has been deleted from your hard disk or moved to a directory where Windows can't find it. ZVSetup uses RegEdit to merge the information stored in the temporary file into the Registry, and without it ZVSetup is powerless to complete the installation. If you see this error message, find REGEDIT.EXE and move it back to your hard disk's Windows directory. Both these errors should be extremely rare.

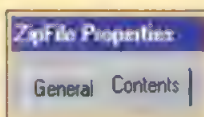
ZVSetup works by creating a temporary text file containing the Registry entries required to make ZipView an active part of your system. It creates the file on the fly by using information retrieved from the Registry, and then it invokes RegEdit with the name of the temporary file as a command line parameter to merge the file's contents into the Registry. By creating the registration file from scratch rather than using a statically defined file, ZVSetup can avoid conflicting with other shell extensions on the off chance that you already have one or more shell extensions installed for .ZIP files.

After setup is completed, the registration file is deleted automatically. If you would like to see what's in the file, press the Ctrl key before clicking the OK button in the Enter ZipView Path dialog and leave it down for a couple of seconds. This will prevent ZVSetup from deleting the file, a feature I originally added to aid in the debugging process. Unless the path to the temporary directory has been modified on your PC, you'll find the file in the \WINDOWS\TEMP directory of your hard disk. The filename will vary, but it will start with the letters REG and have a .TMP extension—for

IN THIS ISSUE

ZipView

ZipView is an extension to the Windows 95 shell that makes working with .ZIP files easier. It adds a Contents page to a .ZIP file's property sheet that displays the file's contents.



Windows 3.x registration database, but it also tracks data that would have been stored in Windows 3.x .INI files. Only after the DLL is properly registered will the Contents page show up in property sheets.

ZipView comes with a setup program called ZVSETUP.EXE that automates the registration process. With ZVSetup to help out, installing ZIPVIEW.DLL and getting it ready to run on your PC is a simple two-step process. First copy ZIPVIEW.DLL to the hard disk directory of your choice. Then run ZVSetup and enter the path to ZIPVIEW.DLL in the dialog box shown in Figure 1. You can type the pathname manually or use the Browse button to search for the file. One caveat: ZIPVIEW.DLL won't show up in the Browse window if "Hide files of these types" is checked in the View page of the Options dialog box that pops up when you select View | Options in an

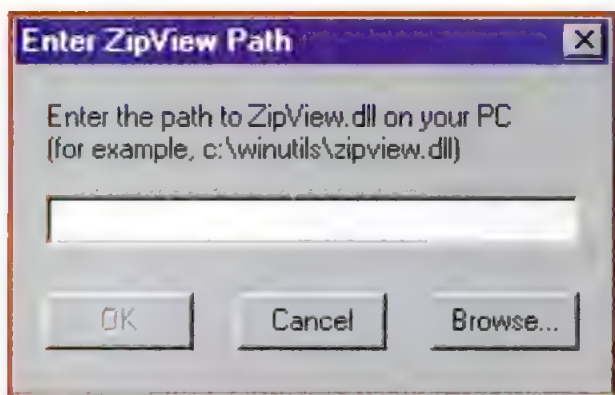


FIGURE 1: ZVSetup displays this dialog box for entering the path to ZIPVIEW.DLL. Once you enter the pathname, setup is automatic.

example, REG45A6.TMP.

Once setup is complete, ZipView should be installed and ready to go. To see it in action, right-click a .ZIP file anywhere in the shell's namespace (for example, in Explorer or in a window representing a folder descended from My Computer), select Properties from the context menu, and click the Contents tab at the top of the window. You should see a list of the files stored in the .ZIP file, similar to the list in Figure 2.

For each file in the archive, ZipView provides seven key items of information: filename, date the file was created or last modified, time the file was created or last modified, file "size" (length in bytes when compressed), file "length" (length in bytes when uncompressed), method used to compress the file (stored, shrunk, reduced, imploded, tokenized, or deflated), and the file's 32-bit cyclic redundancy check (CRC) value. By default, the filenames appear in the order in which they are stored in the .ZIP file, but you can sort by filename or any other category by clicking the corresponding header. For example, clicking Date sorts the filenames by date, while clicking Length sorts files by size when uncompressed.

You can resize a column by dragging the column's divider with the mouse. To widen the File Name column, for example, position the cursor over the vertical line dividing File Name and Date and press and hold the left mouse button. Then move the mouse to the right and release the mouse button when the column is the size you want it. ZipView remembers your column-width preferences, so you only have to set them once.

To extract a file, highlight the filename by clicking it and then click the Extract button. To extract several files at once, click each filename after the first with the Ctrl key held down. You can also select a range of files by clicking the first filename in the range and then clicking the last filename with the Shift key depressed. You can quickly select all the files in the archive by clicking the Select All

button. When you click the Extract button, ZipView extracts all the files whose names are highlighted.

The very first time you extract a file, you'll be presented with the dialog box shown in Figure 3. ZipView needs to know where PKUNZIP is located, since it calls this program to do the unzipping. It's up to you to enter the pathname. If you would like, use the Browse button instead of typing in the pathname. By default, ZipView extracts files to the same directory as the

files from which they're extracted. If you'd like the option of specifying an alternate destination, click the "Prompt for path before extracting" radio button before dismissing the Options dialog. When this feature is enabled, ZipView will prompt you to enter the name of a destination directory each time you click the Extract button. If you later change your mind about any of these options, you can redisplay the dialog by clicking the Options button.

When ZipView invokes PKUNZIP to perform an extraction, a DOS window will appear. If PKUNZIP needs any information from you (for example, a password for an encrypted file or confirmation before overwriting a file), the prompt will appear in this window. By default, the window probably won't close by itself when PKUNZIP is finished; instead, it will hang around until you click the Close button. If you prefer the window to close automatically, go to the folder where PKUNZIP is stored, right-click the PKUNZIP icon, select Properties from the context menu, click the Program tab in the property sheet, and check

the "Close on exit" box near the bottom. Now PKUNZIP will close its own window when it's finished extracting files.

UNINSTALLING ZIPVIEW

The easiest way to uninstall ZipView is to delete ZIPVIEW.DLL from your hard disk. Renaming ZIPVIEW.DLL or moving it to another directory will also disable it. One caveat: If ZipView has been used within the past 20 or 30 minutes, the shell may still have ZIPVIEW.DLL open, in which case it will prevent the file from being deleted, moved, or renamed. If you encounter this problem, restart Windows 95 to force the shell to close the file.

You can go a step further if you'd like and use RegEdit to remove the Registry entries added by ZVSetup. This is purely optional, because the orphaned Registry entries consume next to no disk space and do not slow down your system. It's also something you shouldn't attempt to do unless you're pretty comfortable with RegEdit and know how to get yourself out of trouble if you inadvertently delete the wrong entries. For the power users among you, here's a brief synopsis of the procedure for undoing ZipView's Registry modifications:

1. Look in the Registry under HKEY_CLASSES_ROOT\CLSID for a key named {8e3e0f0a-0f1a-11aa-bcb0-b3fd0e25381a}. An easy way to find it is to use Ctrl-F to find the string "ZipView Shell Extension," making sure the Data check box is checked. Highlight that key and press Del to delete it.
2. Click HKEY_CLASSES_ROOT\zip and look in the right pane of the RegEdit window to determine what the alias for .ZIP files is. The default is zipfile, but it may be different if ZipView wasn't the first .ZIP file shell extension installed on your PC.
3. Look under HKEY_CLASSES_ROOT\alias\shellex\PropertySheetHandlers for another {8e3e0f0a-0f1a-11aa-bcb0-b3fd0e25381a} entry, where *alias* is the name you retrieved in step 2. If this is the only entry that appears under the PropertySheetHandlers key, delete PropertySheetHandlers. Otherwise, delete just the {8e3e0f0a-0f1a-11aa-bcb0-b3fd0e25381a} entry. If you delete PropertySheetHandlers and no other entries are under shellex, you can delete shellex, too. And if you delete shellex and no other entries are under alias, you can delete *alias* as well.
4. If you deleted HKEY_CLASSES_ROOT\alias in Step 3, delete HKEY_CLASSES_ROOT\zip also.

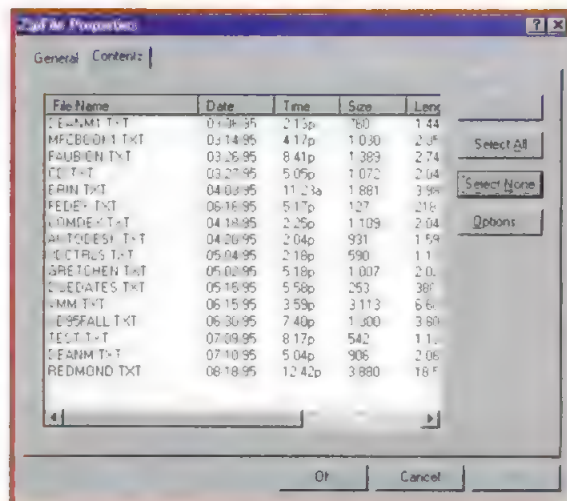


FIGURE 2: The Contents page that ZipView adds to the property sheets of .ZIP files lists a .ZIP file's contents and provides a simple means for extracting files. Clicking a header at the top of the page sorts the list by category.

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If you later decide to install ZipView again, just repeat the installation procedure described in the previous section.

HOW ZIPVIEW WORKS

When you install Windows 95 on your PC, you're not just installing a new operating system; you're embracing a new way of thinking that puts documents first and applications sec-

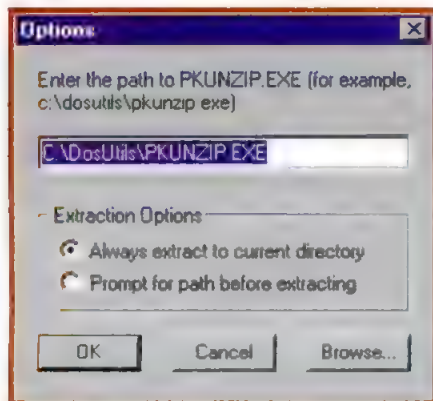


FIGURE 3: The first time you use the Extract button, ZipView's Options dialog prompts you for the path to PKUNZIP. Once you enter the path, you don't have to reenter it unless you move PKUNZIP to another directory.

ond. In Windows 95, documents take center stage, and applications are merely tools for editing them. That's why the Start menu features a recently-used-documents list but not a recently-used-programs list.

So that developers can support the new document-centric user interface paradigm, Windows 95 exposes a number of programmatic interfaces that permit applications to integrate themselves with the shell and manipulate document data as if the shell itself were doing the manipulating. A program that uses these interfaces is known as a *shell extension*.

Our Power Programming column of April 25, 1995, discussed property-sheet shell extensions, which add pages to the property sheets displayed by the shell for shell objects such as files and folders. Other shell extension types include context menu handlers, which add items to context menus; icon handlers, which provide document icons; data handlers, which allow documents to expose their data to other objects using OLE *IDataObject* interfaces; and drop handlers, which use OLE's *IDropTarget* interface to turn documents into drop targets for other objects. There are other types of shell extensions, but these are the ones that will garner the most interest from developers.

The heart of the ZipView DLL is the set of functions used to implement a property-sheet shell extension. For an overview of property-sheet shell extensions and how they work, refer to the Power Programming

column mentioned earlier and to the documentation on shell extensions supplied with the Windows 95 SDK. You might also find it helpful to read my article on shell extensions in the March 1995 issue of *Microsoft Systems Journal* entitled "Integrate Your Applications With the Windows 95 User Interface Using Shell Extensions." With this background in place, you'll find the source code for ZipView a lot more approachable.

A property-sheet shell extension is a DLL housing a component object that meets the specifications of the Component Object Model (COM) upon which OLE is based. That component object is the shell extension itself, which, in the case of a property sheet, implements two OLE-type interfaces: *IShellExtInit* and *IShellPropSheetExt*.

When the property sheet for a .ZIP file is displayed, the Windows 95 shell checks the Registry and sees that ZIPVIEW.DLL contains a property-sheet handler for .ZIP files. It then loads the DLL and calls the DLL's exported *DllGetClassObject* function to create a *class factory object* (COM's term for an object that creates other objects). The shell then calls the class factory's *CreateInstance* method to create the shell extension object containing the property-sheet handler and then uses *IShellExtInit* and *IShellPropSheetExt* methods to communicate with the property-sheet handler.

This might sound convoluted if this is your first exposure to OLE and the Component Object Model, but for better or worse, this is a glimpse at the future of Windows programming. Better to get familiar with it now than to wake up five years from now and realize that you can't access many of Windows' most titillating features through the API.

If you wish to write a property-sheet shell extension of your own, you can copy the *DllMain*, *DllGetClassObject*, and *DllCanUnloadNow* functions, as well as *CClassFactory* and its member functions, from ZIPVIEW.CPP and drop them into your source code. What distinguishes one property-sheet shell extension from another is the implementation of the *IShellExtInit* and *IShellPropSheetExt* interfaces. Both are simple interfaces. *IShellExtInit* contains just one method (*Initialize*), while *IShellPropSheetExt* contains just two, *AddPages* and *ReplacePage*. And for most property-sheet shell extensions, you have to write code only for *AddPages*, because *ReplacePage* is unique to Control Panel

property-sheet extensions. Therefore, *ReplacePage* can be implemented trivially with a handler that simply returns the error code *E_FAIL*.

IShellExtInit::Initialize is called by the shell just before a property-sheet page is displayed. It is prototyped as follows:

```
IShellExtInit::Initialize
(LPSHELLEXTINIT pIface,
 LPCITEMIDLIST pidlFolder,
 LPDATAOBJECT lpdoobj, HKEY hKeyProgID);
```

In C++, the first parameter is passed implicitly as the "this" pointer. For a property-sheet handler, *pidlFolder* is NULL, *lpdoobj* points to an *IDataObject* interface that may be used to identify the file or files to which the property-sheet pertains, and *hKeyProgID* is a Registry key handle that can be read with *RegQueryValue* or *RegQueryValueEx* to identify the document type. For ZipView, *hKeyProgID* references the string assigned to the *HKEY_CLASSES_ROOT\zipfile* key (by default, *PKZIP Archive*).

ZipView's implementation of *Initialize*, which is found in *CShellExtension::Initialize*, calls *IDataObject::GetData* through the

```
PROPSHEETPAGE psp;
HPROPSHEETPAGE hPage;

psp.dwSize = sizeof (psp);
psp.dwFlags = PSP_USEREFPARENT | PSP_USETITLE;
psp.hInstance = g_hInstance;
psp.pszTemplate = "ZipContents";
psp.pszTitle = "Contents";
psp.pfnDlgProc = (DLGPROC) PageProc;
psp.lParam = (LPARAM) m_szFile;
psp.pcRefParent = &g_cRefThisDll;

hPage = CreatePropertySheetPage (&psp);

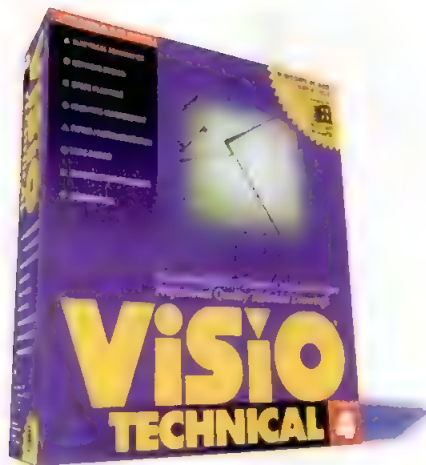
if (hPage != NULL)
    if (!lpfnAddPage (hPage, lParam))
        DestroyPropertySheetPage (hPage);

return NOERROR;
```

FIGURE 4: The function shown here adds the Contents page to the property sheet.

lpdoobj pointer to render the data to an *HGLOBAL* storage medium in *CF_HDROP* format:

```
STGMEDIUM medium;
FORMATETC fe = { CF_HDROP, NULL,
 DVASPECT_CONTENT, -1,
 TYMED_HGLOBAL };
.
.
.
HRESULT hr = lpdoobj->GetData (&fe,
 &medium);
```

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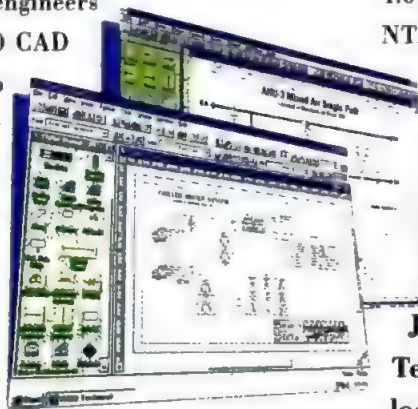
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The resulting storage medium is formatted exactly like an HDROP object used in Windows 3.1-style drag-and-drop. ZipView then uses DragQueryFile to retrieve the filename from the storage medium and stores it away in ShellExtension::m_szFile so it can be used again later:

```
DragQueryFile ((HDROP) medium.hGlobal,
0, m_szFile, sizeof (m_szFile));
```

First, however, it calls DragQueryFile with a second parameter equal to -1 to retrieve the number of filenames contained in the storage medium. If that number is other than 1 (if the property sheet pertains to two or more .ZIP files), CShellExtension::Initialize returns E_FAIL so the Contents page will not be displayed. Otherwise it returns NOERROR, indicating that the property-sheet handler was successfully initialized.

How did drag-and-drop enter the picture? It didn't, really. Faced with the task of converting an IDataObject pointer into a filename or list of filenames, an application has one recourse: to "render" the filename(s) in HDROP format and use drag-and-drop functions to extract filenames from the rendered data. Unusual, yes; but that's the way OLE works.

If initialization is successful, the shell next calls IShellPropSheetExt::AddPages to give the property-sheet handler the opportunity to add one or more pages to the property sheet. AddPages receives two parameters in addition to the "this" pointer referencing the IShellPropSheetExt instance: a function address for adding pages to the property sheet and an lParam value that must be passed to that function when it is called.

Before making the function call, the property-sheet handler initializes a PROPSHEETPAGE structure with parameters defining the new property-sheet page and creates the page with the API function CreatePropertySheet-

```
LV_COLUMN lvc;
for (int i=0; i<7; i++) {
    lvc.mask = LVCF_FMT | LVCF_WIDTH | LVCF_TEXT;
    lvc.fmt = LVCFMT_LEFT;
    lvc.cx = nWidths[i];
    lvc.pszText = pszLabels[i];
    ListView_InsertColumn (hwndListView, i, &lvc);
}
```

FIGURE 5: The code shown here creates the columns in the ListView control used by ZipView.

Page. The handle returned by CreatePropertySheetPage is then passed to the function that adds the page to the property sheet, as shown in Figure 4.

A property-sheet page is basically a dialog box in disguise. Accordingly, PROPSHEETPAGE's pszTemplate and pfnDlgProc mem-

bers identify a dialog template and dialog procedure. ZipView copies the filename stored in m_szFile to the structure's lParam member so that the dialog procedure—which receives the address of the page's PROPSHEETPAGE structure in the lParam parameter accompanying the WM_INITDIALOG message—can retrieve the filename itself. Note that the property-sheet page is destroyed with DestroyPropertySheetPage if the call to add the page to the property sheet fails. The page need not be destroyed if the call succeeds, because the page will be destroyed automatically when the property sheet is destroyed.

The dialog procedure that processes messages to the new property-sheet page is named PageProc. It looks much like a conventional dialog procedure, but it never calls EndDialog. Property-sheet page procedures should never call EndDialog, because doing so would destroy the property sheet prematurely. (Property sheets are destroyed for you when OK or Cancel is clicked.) If you start with PageProc and think of it as a normal dialog procedure, ZipView's source code won't look much different to you than the source code for a conventional Windows application written in C. The only thing that's likely to be unfamiliar is PageProc's use of a ListView control, which is one of the new common controls featured in Windows 95. Let's look at this aspect of the ZipView DLL more closely.

THE LISTVIEW CONTROL

The window containing filenames on the Contents page is a ListView control, which programmers often refer to simply as a *ListView*. A ListView is similar to a list box, but its feature set is much richer. For example, a ListView provides the header that appears at the top of the window. (That header is actually another common control type called a *header control*.) It allows its column widths to be adjusted interactively, and it notifies its parent when a header item is clicked.

A ListView also supports different views of its data. ZipView uses an LVS_REPORT-style view, which presents data in tabular form. Other ListView styles include LVS_ICON, or large-icon view; LVS_SMALLICON, or small-icon view; and LVS_LIST, or list view. The right pane of the Explorer window is a ListView

```
if (nFiles > 0) {
    LV_ITEM lvi;
    for (i=0; i<nFiles; i++) {
        lvi.mask = LVIF_TEXT | LVIF_PARAM;
        lvi.iItem = i;
        lvi.iSubItem = 0;
        lvi.pszText = LPSTR_TEXTCALLBACK;
        lvi.lParam = (LPARAM) &pszf1[i];
        ListView_InsertItem (hwndListView, &lvi);
    }
}
```

FIGURE 6: After adding the columns, ZipView adds the ListView items—the filenames that appear in the leftmost column. The data in the columns to the right are referred to as subitems.

control. You can see examples of all four view styles by selecting Large Icons, Small Icons, List, and Details from Explorer's View menu.

The ListView control is created by the following statement in the dialog template for the Contents property-sheet page:

```
CONTROL "", IDD_LISTVIEW, WC_LISTVIEW,
WS_CHILD | WS_VISIBLE |
WS_BORDER | LVS_SHOWSELALWAYS |
LVS_REPORT, 8, 12, 224, 176
```

WC_LISTVIEW is the window class and is defined in commctrl.h. The LVS_SHOWSELALWAYS style configures the ListView to show selections even when it doesn't have the input focus, and the style LVS_REPORT selects report view. Normally, an application that uses a common control calls the InitCommonControls API function to load and initialize the common controls DLL, but the fact that the ListView appears in a property sheet (which is also a common control) means it's safe to assume that the DLL is already loaded.

The dialog procedure for the Contents page, PageProc, initializes the ListView control by calling InitListView from WM_INITDIALOG. InitListView is a local function that begins by adding seven columns to the ListView control. A column is created by initializing an LV_COLUMN structure with column attributes such as width and title and calling the ListView_InsertColumn macro, which is little more than a wrapper around an LVM_INSERTCOLUMN message. Figure 5 shows the code that is used to create the columns.

Column titles are stored in the pszLabels array and column widths in nWidths. Before the for loop is executed, GetColumnWidths is called to initialize the nWidths array. If ZipView has been run before, the column widths are retrieved from the Registry; otherwise, nWidths is filled with default column-width values. Column widths are written to the Registry with SaveColumnWidths when-

ever PageProc receives a PSN_APPLY or PSN_RESET notification indicating that OK, Apply, or Cancel was clicked. In this way, ZipView preserves column widths so that once set, they remain set until changed again.

After adding the columns, InitListView adds items to the ListView control using the ListView_AddItem macro. In ZipView, items are the filenames that appear in the leftmost column. Data in the columns to the right is referred to as subitems.

In report view, a given row and column are identified by a 0-based item (line) number and a 0-based subitem (column) number in the iItem and iSubItem fields of an LV_ITEM structure. Rather than specifying text for the items and subitems, ZipView specifies LPSTR_TEXTCALLBACK in the structure's pszText field so the ListView control will notify its parent when it needs text (see Figure 6).

Subitems 1 through 6 are not registered, because they are implicitly created when the columns are added and they default to LPSTR_TEXTCALLBACK. The value copied to the lParam field is a pointer to a ZIPFILEINFO structure containing the filename, date, time, and other information for the corresponding line in the table. The pzfi array (an array of ZIPFILEINFO structures) is initialized when PageProc's WM_INITDIALOG handler calls GetZipFileInfo to scan the .ZIP file and extract information about the files contained in the archive.

Like most of the other common controls, a ListView control communicates with its parent via WM_NOTIFY messages. When a WM_NOTIFY message arrives, lParam points either to an NMHDR structure or to a structure that is a superset of NMHDR containing details concerning the notification. NMHDR is defined as follows in winuser.h:

```
typedef struct tagNMHDR
{
    HWND hwndFrom;
    UINT idFrom;
    UINT code;
} NMHDR;
typedef NMHDR FAR * LPNMHDR;
```

The code field contains the notification code—for example, LVN_COLUMNCLICK when a column header is clicked. Because the text of all its items and subitems is LPSTR_TEXTCALLBACK, ZipView's ListView control sends PageProc a LVN_GETDISPINFO notification when an item or subitem is about to be displayed. lParam points to an LV_DISPINFO structure, which is an NMHDR structure with an LV_ITEM structure tacked on. PageProc casts lParam to an LV_DISPINFO pointer and calls GetDispInfo, and GetDispInfo uses the subitem number stored in LV_DISPINFO to retrieve a value from the corresponding ZIPFILEINFO struc-

ture. It then translates the value into a text string and copies the string to the pszText buffer whose address is provided in the LV_DISPINFO structure, providing the ListView control with the text that it requested.

The primary reason ZipView uses callbacks for its text strings is so that ListView entries can be sorted. You'll run into all sorts of problems if you try sorting the items in a ListView control whose text is statically de-

The only trick to
extracting the files is
determining when
PKUNZIP has finished,
so that the temporary file
can safely be deleted.

finied, but when text is supplied in response to callbacks, most of the work is done for you. When a header item is clicked, the ListView control sends its parent an LVN_COLUMNCLICKED notification with lParam pointing to an NM_LISTVIEW structure containing a subitem number identifying the column. PageProc responds to LVN_COLUMNCLICKED notifications by calling ListView_SortItems to sort ListView's contents, passing it the subitem number and the address of a callback function named CompareFunc.

The control does the sorting, but it uses the callback function to let the parent decide how each item is ordered relative to the others. ListView calls CompareFunc repeatedly, each time passing a pair of lParam values identifying ZIPFILEINFO structures for the corresponding ListView items. CompareFunc consults the ZIPFILEINFO structures (using the subitem number passed to ListView_SortItems to determine which member of ZIPFILEINFO to sort on), performs the comparison, and returns a negative, positive, or 0 value indicating the items' relative positions.

Using an application-defined comparison function enables a ListView control to sort any type of data, whether string-based or binary. It also provides a tremendous amount of flexibility in the sorting process, allowing the implementor to decide how items should be compared and, if desired, how to break ties when two items compare identically using the primary sort key. ZipView, for example, automatically uses time stamps to break ties between files with identical date stamps when a sort is per-

formed by date. See CompareFunc for details of the comparison process for each of the seven possible sort categories.

EXTRACTING FILES

When the Extract button is clicked, ZipView extracts files by calling its own ExtractFiles function. After making sure that it has a path to PKUNZIP.EXE and prompting the user for one if it doesn't, ExtractFiles formulates the path to the directory to which files will be extracted. If the "Always extract to current directory" option is set, the extraction path points to the same directory that the .ZIP file is in. If "Prompt for path before extracting" is selected instead, ExtractFiles presents the default path to the user in a dialog box so the pathname can be changed. The default path is either the directory that contains the .ZIP file or, if a pathname has been entered before, the previously used pathname. This way, if there's a certain directory to which you like to extract archived files, you don't have to enter the pathname over and over.

Once the extraction path is set, ExtractFiles creates in the specified directory a temporary text file that contains names of the files to extract. The work is done by CreateListFile, which retrieves names of the selected files from the ListView control using the ListView_GetItemText macro and writes them to the file using Win32 file I/O functions.

The files are then extracted by invoking PKUNZIP with a command of the form:

```
pkunzip -e ZipFileName @TempFileName
```

where ZipFileName is the name of the .ZIP file and TempFileName is the name of the temporary file. PKUNZIP is executed using the Win32 CreateProcess function, which is capa-

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- 2 **WCOMP** Compares two text files
- 3 **FHUNT** Enhanced search tool
- 4 **FDDLLS** Finds dead DLLs
- 5 **STRING** Batch file enhancer
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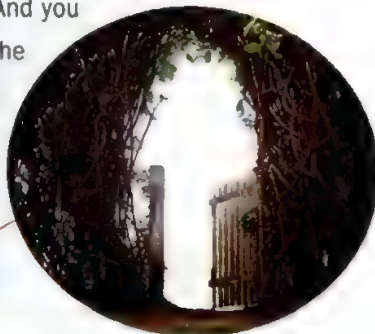


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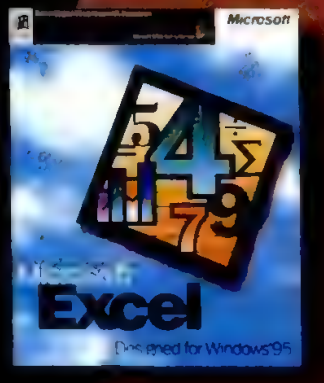
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ble of starting MS-DOS processes as well as Win16 and Win32 processes. After PKUNZIP is finished, ExtractFiles cleans up after itself by deleting the temporary file, leaving behind only the files extracted from the archive.

The only trick to extracting the files is determining when PKUNZIP has finished, so that the temporary file can safely be deleted. In the Win32 environment, processes are started and run asynchronously, so CreateProcess returns as soon as a process is started. ExtractFiles can't delete the temporary file immediately after CreateProcess returns, because it is highly likely that PKUNZIP will still be running. Therefore, if CreateProcess returns a nonzero value indicating that PKUNZIP was successfully started, ExtractFiles calls the Win32 API function WaitForSingleObject with the handle for the new process (which is copied to the hProcess member of the PROCESS_INFORMATION structure *pi* by CreateProcess) to wait until the process terminates:

```
WaitForSingleObject (pi.hProcess,  
INFINITE);
```

The second parameter, INFINITE, means WaitForSingleObject will wait however long it takes for PKUNZIP to run its course. Waiting is efficient when performed in this manner, because the thread containing ExtractFiles is suspended until the process ends, and a suspended thread consumes virtually no processor time.

AND THERE'S MORE!

There's plenty more to be gleaned from ZipView's source code, but, unfortunately, its length prohibits a line-by-line analysis. If you'd like to see how program settings such as column widths and the path to PKUNZIP are written to and retrieved from the Registry, check out ZipView's GetColumnWidths, SaveColumnWidths, GetPathToPkunzip, and WritePathToPkunzip functions. Reading and writing Registry information is

easy, thanks to Win32 API functions such as RegQueryValueEx and RegSetValueEx. To learn more about how ZipView determines what's stored in a .ZIP file, look at GetZipFileInfo, which uses Windows 95's memory-mapped file capabilities to make file parsing a snap. For information on the .ZIP file format, refer to the APPNOTES.TXT file that accompanies PKZIP.

ZipView is just one example of the new breed of applications that Windows 95 makes possible. As applications like ZipView become more prevalent, Windows 95 will come closer to achieving its goal of providing a document-oriented interface for users to manipulate the data stored on their computers. Give ZipView a try and you can decide for yourself whether this is a goal worth striving for. □

Jeff Proise is a contributing editor of PC Magazine. His new book, Programming Windows 95 with MFC, is scheduled to be published this winter by Microsoft Press.

GUIDE TO OUR UTILITIES

ABOUT ZIPVIEW

DESCRIPTION: ZipView is an extension to the Windows 95 shell that makes working with .ZIP files easier. It adds a Contents page to a .ZIP file's property sheet that displays the file's contents. You can select files for extraction by highlighting them and clicking the Extract button.

USAGE: To install ZipView, copy ZIPVIEW.DLL to a directory on your hard disk and run ZVSetup. This adds lines to your Registry that tell Windows 95 how and when to use ZIPVIEW.DLL.

ZVSetup will ask you for the path of ZIPVIEW.DLL. You can type in the pathname or use the Browse button to search for the file. Note that ZIPVIEW.DLL won't show up in the Browse window if "Hide files of these types" is checked in the View page of the Options dialog box (select View | Options in an Explorer window).

To use ZipView, right-click a .ZIP file anywhere in the shell's namespace (for example, in Explorer or in a window representing a folder descended from My Computer), select Properties from the context menu, and click the Contents tab at the top of the window. You will see a list of the files stored in the .ZIP file. To extract, highlight one or more filenames and click the Extract button. ZipView uses PKUNZIP to do the actual extracting and will ask you where this file is stored the first time you extract.

FILES:

ZIPVIE.EXE—A self-extracting archive that will create the necessary files to install and run ZipView.

ZIPVIE.TXT—The documentation file.

ZIPVIE.ZIP—The source, program, and documentation files.

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PC Solutions

TIPS AND TECHNIQUES TO INCREASE YOUR PRODUCTIVITY

User-to-User

By Neil J. Rubenking

SUBST Conflicts with 32-bit File Access

The SUBST command is a great way to streamline cluttered directories, but it is incompatible with 32-bit file access under Microsoft Windows for Workgroups 3.11. If you attempt to use the SUBST command with 32-bit access enabled, one of two things happens when you enter Windows for Workgroups: The system completely locks up on a blank screen after displaying the Windows logo, or an error message informs you that 32-bit file access is incompatible with the SUBST utility.

Unfortunately, the only way to utilize the SUBST command is to disable 32-bit file access.

IAN PROFFER, Chicago, Illinois

PC MAGAZINE: The Microsoft Developer's Network CD-ROM confirms this incompatibility. If you enable 32-bit file access and use the SUBST command to assign one or more directories to imaginary drive letters, your system either hangs on a black screen or displays the error message, "The 32-bit File System is Incompatible with the SUBST Utility. To Use 32-bit File Access, Do Not Use the SUBST Utility Before Starting Windows for Workgroups."

Using SUBST in a DOS box under Windows is always a bad idea. If you try it with 32-bit file access enabled, you get the peculiar message that reads, "Cannot SUBST a Network Drive." Do not let this throw you; it is just another effect of the incompatibility.

While 32-bit file access can speed up every file operation on your system, SUBST can occasionally make it easier to refer to a long directory name. If you have to choose between them, 32-bit file access is the obvious winner.

Revisiting Efforts to Change Drive and Directory

The small batch file CDD.BAT—which was proposed in the User-to-User column of January 10, 1995—can change both drive and directory at the same time (see Figure 1). If you attempt to change to a drive that has nothing in it, however, the CTTY NUL command inter-

cepts DOS's Abort, Retry, Fail? error message. CTTY NUL also intercepts any attempt to press Abort or Fail, which means you have no alternative but to reboot your system. To solve this problem, I simply deleted the CTTY commands.

DAVID VAUGHAN, via ZD Net

The CDD.BAT batch file in Figure 1 cannot change to the root directory of another drive. If you issue a CDD A:\ command, for instance, the IF EXIST %1\NUL %1\ test becomes IF EXIST A:\NUL. In this case, the system does not find A:\NUL, and the current drive does not change.

If you put a period after the passed parameter, however, you force DOS to check in the current directory:

```
IF EXIST %1.\NUL %1\.
```

In this case, a CDD A:\ command results in IF EXIST A:\NUL, which correctly changes to the A:\ drive. This test still works for most non-root directories, but it does not work for directories

```
@ECHO OFF
CTTY NUL
IF EXIST %1\NUL %1\
CTTY CON
CD %1
```

FIGURE 1: This version of CDD.BAT—which originally appeared in the User-to-User column of January 10, 1995—has several deficiencies.

that have an extension. To cover all directories, you must use both IF EXIST %1.\NUL %1\ and IF EXIST %1\NUL %1\.

DENIS SLATTERY, via ZD Net

PC MAGAZINE: The CDD.BAT file in Figure 1 is a slimmed-down response to an even earlier version, which appeared in the User-to-User column of January 11, 1994. Not only does it encounter problems with the scenarios described above, but the IF EXIST %1\NUL %1\ test also fails on CD-ROM drives. Figure 2 is a brand-new CDD.BAT that fixes all these problems.

The new and improved CDD.BAT first checks whether its second parameter is [AGAIN]. If not, it re-executes itself under a secondary command processor using the /F command line switch. When COMMAND.COM runs with the /F switch, it automatically an-

HIGHLIGHTS



HARDWARE Can your Windows system get 32-bit disk access with both your hard disk and your CD-ROM drive? Alfred Poor explains. Page 270



OPERATING ENVIRONMENTS DOS 6.2's multiple-configuration menus give you a choice of expanded or extended memory configurations. Page 274



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```
@ECHO OFF
IF '%2'=='{AGAIN}' GOTO Again
::- Re-execute with COMMAND /F, to automatically fail
::- when an "Abort, Retry, Fail?" error occurs
%COMSPEC% /F /C %0 %1 {AGAIN}
GOTO End
:Again
CTTY NUL
::- test #1 good for subdirectories
IF EXIST %1\NUL GOTO Ok
::- test #2 good for root directories
IF EXIST %1.\NUL GOTO Ok
::- test #3 good for subdirectories on CD-ROM
```

```
IF EXIST %1\.* GOTO Ok
::- test #4 good for root directories on CD-ROM
IF EXIST %1.\.* GOTO Ok
GOTO Baddrive
:Ok
::- Switch to specified drive
%1\
:BadDrive
CTTY CON
::- Switch to specified directory
CD %1
:End
```



FIGURE 2: This new version of CDD.BAT changes drive and directory at once while avoiding the pitfalls of the version in Figure 1.

swers an Abort, Retry, Fail? error message with a Fail.

The new CDD.BAT also performs up to four tests that make sure the chosen drive and directory are valid. To catch both the root directory and any directory with an extension, it tests the existence of both %1\NUL and %1.\NUL (as Mr. Slattery suggested). Since tests that use the NUL device do not work with CD-ROMs, CDD.BAT also tests the existence of %1*.* and %1.*.*. The only scenario that can slip through all four tests is a CD-ROM directory that contains no files.

Unfortunately, these tests balloon CDD.BAT from 3 essential lines back to 17 essential lines. (You can download this file from PC Magazine Online. See the sidebar "Guide to Our Utilities" for instructions.) If you wish to do away with a complex CDD.BAT file and are not concerned with spurious error messages, try putting this line in your AUTOEXEC.BAT instead:

```
DOSKEY CD=%1\&tCD %1
```

This DOSKEY macro, which replaces the regular CD command, changes drive and directory automatically. When you use it with a relative path name (CD SYSTEM, for instance, when the current directory is C:\Windows), you get a Bad Command or File Name message, but the macro still changes to the correct directory. If you type a space before this or any other DOSKEY macro that replaces a DOS command, you get the old command rather than the macro.

Enable DOS 6's File Manager Enhancements

There's support in File Manager for an Undelete command, and DOS 6.x provides the necessary .DLL to implement this feature. To add the Undelete command to your File menu (right below Delete), just add the statement

```
UNDELETE.DLL=C:\DOS\MSTOOLS.DLL
```

to the [Settings] section of WINFILE.INI (remember to adjust the command to your own DOS directory). This command calls the Windows Undelete command from the current directory, so it's easier to undelete a file you've just erased.

PATRICE BERNARD,
Utsunomiya, Tochigi, Japan.

PC MAGAZINE: Undelete for Windows is normally enabled during the process of upgrading to DOS 6.0 or later, but you can choose not to install it. Reinstalling all of DOS just to add Windows Undelete support later would be a major pain, and luckily it's not necessary. As long as the MSTOOLS.DLL file is present in your DOS directory, you can enable Windows Undelete with the simple change to WINFILE.INI listed above. Figure 3 shows the Windows Undelete utility as activated from File Manager.

Two other Windows utilities are optionally installed with DOS 6.x, Backup and Antivirus. You can also add support for these even if you omitted them during the initial DOS upgrade. Find or create the section heading [AddOns] in WINFILE.INI and add the line

```
MS-DOS Tools
Extensions=C:\DOS\MSTOOLS.DLL
```

Actually, the text to the left of the equal sign is irrelevant—it doesn't really matter what you enter. But it's probably a good idea to make it meaningful.

When you start File Manager after making this change, a Tools menu will appear between the Options and Window menus on the main menu bar. From this menu you can start MS Backup for Windows, launch MS Antivirus for Windows, and get information about any drives you've compressed with DriveSpace or DoubleSpace.

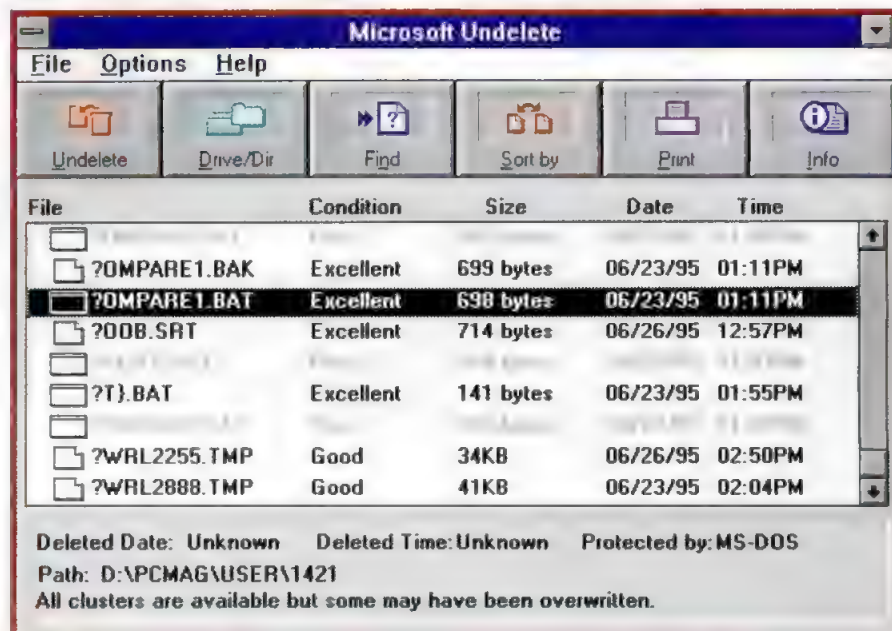


FIGURE 3: A simple change in WINFILE.INI adds the Windows version of DOS 6.x's Undelete command to File Manager.

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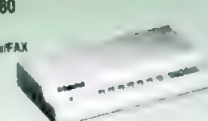
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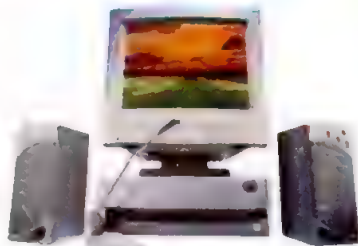
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1280MB	10ms	3.5"	1.00	IDE	64	4,500 WD31200A	269	319
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I have a Sony IDE CD-ROM drive and an IDE hard disk attached to the same cable, with the hard disk set as the master and the CD drive as the slave. If I have 32-bit disk access turned off, Windows 3.1 works great, but it crashes if I try to access the CD with 32-bit disk access turned on. Do you have any ideas on how to resolve this?

ARIEL BARRERA, Edison, New Jersey

PC MAGAZINE: The Windows 3.1 32-bit disk access feature relies on the WDCTRL driver, which works with any disk drive compatible with the Western Digital 1003 hard disk standard. Since no CD-ROM is compatible with this standard, no CD-ROM drive supports 32-bit disk access.

All is not lost, however; you can have your 32 bits and your CD drive, too. You can either replace your existing hard disk controller with an Enhanced IDE controller or you can add a second compatible controller that provides a secondary channel. Connect your CD-ROM

drive to the secondary IDE channel as master and it will not interfere with 32-bit disk access to your hard disk on the primary IDE channel. This is a relatively inexpensive fix and should restore the disk performance you were used to before you added the CD-ROM drive. You can also upgrade to Windows 95, which will allow 32-bit access on both drives.

—Alfred Poor

Using Printer Symbol Sets

I use an HP LaserJet 4MP with Windows 3.1. There's a collection of Symbol Set tables in the back of the printer manual, and I'd like to use set 9T, PC-Turkish, which has symbols I can't locate anywhere else. I called Hewlett-Packard, but surprisingly they couldn't tell me how to use them. Can you?

DANIEL L. BURKETT, Dallas, Texas

PC MAGAZINE: Few people realize that dozens of handy symbols lie waiting inside their LaserJets. There's little software that makes it easy to take advantage of these characters,

however, so perhaps it's not so surprising they remain a secret.

The symbols are available for the internal (or resident) fonts in the printer, though some are available only for the scalable (not bit-mapped) fonts. The command to select one of these symbol sets for the current font is

<ESC>(id

where <ESC> is the Esc character (ASCII 27) and id is the Symbol Set ID number.

Thus, to use the PC-Turkish symbols, you need to send the printer the command <ESC>(9T—9T is the ID for that set. Then send the ASCII values of the characters you want to print; refer to the table in your manual for these values. With some DOS word processors—such as XyWrite—that essentially would be that; you'd simply embed the command in your document and everything would work fine.

It's not always as easy to do the same within Windows programs. First you need to select a font that is resident in your printer. In most Windows programs, these are indicated on a font list by a printer symbol, as opposed to the double-T TrueType symbol. Next you must send the printer command that selects the Symbol Set. Finally, you need to insert the

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APS MS 4.0W ³ Micropolis	4095mb	1199 ⁹⁵	1299 ⁹⁵
APS Q 4.0W ³ Quantum	4101mb	1399 ⁹⁵	1499 ⁹⁵
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ASCII value required to print the desired character. In Microsoft Word for Windows, you can use the PRINT field to send control codes and the SYMBOL field to send ASCII values; remember to precede the ASCII value with a leading zero so that it's interpreted as an ASCII character and not as an ANSI symbol. Both the PRINT and SYMBOL fields are available via the Insert | Field menu.

It may take some research in your program's documentation, but you should be able to put those special characters to use.

—Alfred Poor

Bay Watch

I want to add another CD-ROM drive to my system, but while I have plenty of empty drive bays inside the case, the cover has no removable front openings for them. How am I supposed to get at them? Why do manufacturers supply all these inaccessible extra bays? I've seen reviews that mention as many as nine non-accessible bays.

JOHN E. AHERN, Chicago, Illinois

PC MAGAZINE: There are many reasons for those internal bays, but they won't help solve your problem. There are at least three solutions, however, that will cost you \$100 or less.

First, you could purchase an external CD-ROM drive. You can't get an external IDE drive, but most SCSI drives are available in both internal and external versions. The external drives typically cost roughly \$100 more than their internal stablemates.

If you don't want the bother of an external drive, you may be able to combine two devices that currently take up two accessible bays. The most likely candidates are floppy disk drives: You can find a combo drive suitable for both 5.25- and 3.5-inch disks that will fit into a single 5.25-inch half-height bay for under \$100. And if you have a PC Card (formerly known as a PCMCIA Card) slot in your system, you can find combo 3.5-inch floppy disk and PC Card drives that fit in a half-height bay.

Finally, consider purchasing a new case (though this is the most labor-intensive solution). A typical full-size tower case will have six or more half-height bays open to the outside world, ready for your removable media drives. Even with a 250-watt power supply, you can find one for well under \$100.

As to why there are so many inaccessible bays, I'll admit I've never seen a system that actually uses nine, but it's not hard to imagine using almost that many. The number is typically reported in terms of half-height bays, but there are plenty of full-height hard drives still in use. Load a system with a pair of these disks and you've filled "four" bays already. Also, many vendors tuck bays for 3.5-inch hard drives in spaces where a 5.25-inch drive would

never fit; it doesn't add much to the cost of the system, and it provides some configuration flexibility should you need it.—Alfred Poor

The Color Purple

The monitor on my two-and-a-half-year-old system has developed a flicker, and occasionally the screen flips from clear to a purplish cast and then back to clear again. Also, about half the time I have no color in DOS applications. Tech support suggested that I try a new monitor cable. Removing my extension cable made no difference, and I can't try a different cable because one end is permanently attached to the monitor. I can't tell whether my problem is the graphics adapter or the monitor. Can you suggest how I might test my system or what I could do to correct this problem?

TERRY FLOHE, Byron Center, Michigan

PC MAGAZINE: It sure sounds as if you have some sick hardware, but fortunately it should be easy enough to isolate the problem. The purplish hue would seem to indicate that you're losing some or all of the green signal, leaving only the red and blue signals operating. But this doesn't correlate well with the no-color-in-DOS symptom, since all three signals must come through equally to create a white image. In any case, since the monitor can't tell when it's in DOS and when it's in Windows but the graphics adapter can, I suspect it's the graphics card that has the problem.

The easiest way to discover the source of the problem is to swap either the graphics adapter or the monitor. The monitor may be easier—you may be able to try your monitor on a friend's system or vice versa. This should help identify the problem quickly.

If the card is bad, your only solution is to replace it. If the monitor isn't working correctly, however, it may be worth repairing. You may well be able to get fairly major repairs accomplished for around \$100, which is enough less than the price of a new monitor to make it worth considering if you're otherwise happy with the display.—Alfred Poor

OPERATING ENVIRONMENTS

Recovering a Deleted Program Group



When I installed Borland C++ 4.0 under Microsoft Windows 3.1, a program group was created, filled with icons for the various programs that came with the package (like C++, Resource Workshop, WinSight, and so forth). Somehow, though, I managed to delete this group. Is there a quick way to restore the program icons in it, or will I have to create each one again, one at a time?

JOHN KOTTAL, Lafayette, Colorado

PC MAGAZINE: When you delete a program group, Program Manager also deletes the .GRP file on disk that defines the contents of the group window. If you realize immediately that the deletion was a mistake, you can use the UNDELETE function in a DOS box or File Manager to undelete the .GRP file. Then in Program Manager, choose New from the File menu and check the Program Group box. Enter the name for the program group window and the name of the .GRP file you just undeleted. That should restore the group.

If you aren't able to undelete the .GRP file, there's still hope. Create a new empty group window in Program Manager with the desired name. Now launch File Manager, select Search from the File menu, and enter *.EXE in the Search For line. Enter the name of the directory containing the files from your lost group in the Start From line and remove the check next to Search All Subdirectories. Press OK and select all the found files in the Search Results window. Now drag that block of files from File Manager into your reconstructed group file. That should give you a good start on duplicating the demolished group.

—Neil J. Rubenking

Too Much Protection

*I have Delete Sentry protection turned on, using the command UNDELETE /SC in my AUTOEXEC.BAT file. I've noticed that whenever I use the MORE filter, as in the command DIR | MORE, files are created in my Sentry directory. I know that MORE normally creates temporary files and then deletes them, but with Sentry protection on, the files are not actually deleted. Instead they are moved to the hidden Sentry directory. To prevent this, I modified the UNDELETE.INI file to exclude any file with a *.MS extension (the extension that MORE gives its temporary files) from Sentry protection, as follows:*

```
[sentry.files]
sentry.files=*. *  *.MS *.TMP *.VM?
➔*.WOA *.SWP *.SPL *.RMG *.IMG
```

But, for some reason, this is not working, and every time I use MORE I get another unwanted file in my Sentry directory. Can you tell me what's happening?

DON MATTHEWS, Merrick, New York

PC MAGAZINE: Delete Sentry is the highest level of protection DOS's UNDELETE program offers. When Delete Sentry protection is enabled for a particular drive, DOS doesn't delete files from that drive at all. Instead, it renames them and relocates them in a hidden directory—a kind of witness-protection program for files. The directory is always named SENTRY, and it's found in the root directory of the protected drive. Within that directory, a

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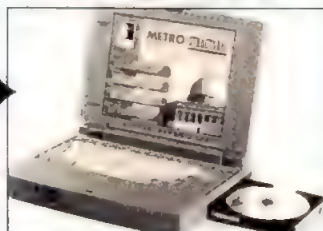
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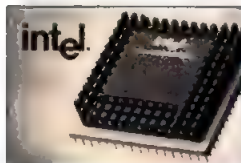
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file named CONTROL.FIL keeps track of the connection between the stored files and their original names.

It is aggravating to find that UNDELETE is filling up your Sentry directory with useless copies of temporary files. Clearly, you've peeked into C:\SENTRY and seen the files with

```
@ECHO OFF
REM SEETEMP.BAT - view temporary files created
REM during redirection. DOS 5.x or later.
ECHO foo | DIR %TEMP% /O:D
ECHO The last two files were created by piping.
```

FIGURE 1: Run this batch file to get a look at the elusive temporary files DOS creates to handle redirection.

the .MS extension. You're not seeing the real names of the files, however; you're just seeing the names UNDELETE gave them. The temporary files have unique eight-character names with no extension, such as AKCNDGCG or AKCNDGCL. Note that these temporary files aren't specific to the MORE command; DOS creates them every time you use the pipe (|) symbol for redirection. Run the batch file listed in Figure 1 to see a couple of examples.

To avoid having UNDELETE store copies of the deleted temporary files, you'll have to forfeit Delete Sentry protection for all files that have no extension. If that's acceptable to you, simply substitute "*" for "*.MS" in the sentry .files= line of your UNDELETE.INI file.

—Neil J. Rubenking

Strange Symptoms in OS/2 Warp

I'm getting frequent SYS3175 errors in Win-OS/2 sessions. . .

My DOS sessions occasionally lock up. . .

Sometimes when I open a Windows program, the icon is grayed, but the program won't start. . .

I'm getting occasional Trap 000E errors when running Windows applications. . .

PC MAGAZINE: A confusing collection of complaints like these have begun cropping up regarding OS/2 Warp. In fact, the number of difficulties in DOS and Win-OS/2 sessions seems to be steadily increasing. At first glance, the problems don't seem connected, nor does there seem to be any reason (other than continuing sales of Warp itself) that the number of problems is increasing.

After a bit of detective work, though, the connection begins to emerge: The problems occur only on recent high-end systems—specifically, those containing 486 or Pentium processors manufactured after May 1994. OS/2 exploits the Intel hardware's capability to

switch between protected-mode sessions (to run native programs) and real mode sessions (to run DOS and Windows programs). In May 1994, Intel instituted a change in its processors designed to help that switching take place more quickly.

Unfortunately, a compatibility problem seems to exist between that modification and OS/2 that can cause a variety of unusual symptoms in DOS and Win-OS/2 sessions. Luckily, a simple solution seems to exist as well. If you have one of the newer machines and you're experiencing problems with

DOS and Windows programs, add the line VME=NO to the bottom of your CONFIG.SYS file, then shut down and reboot. This tells OS/2 not to use the Virtual Mode Extensions in the later processors. No known problems occur when you add this setting, and in many cases it causes those mysterious difficulties to vanish!—Brian Proffitt

Making DOS's Multiple-Configuration Menu System Work

DOS 6.22's CONFIG.SYS menu system is giving me problems. I constructed a menu to let me choose between expanded or extended memory at boot-up. Though the menu seemed to work fine, I was unable to load certain programs due to insufficient memory. After much frustration, I deleted the menuitem= entries from my CONFIG.SYS file and found I had sufficient memory again.

I'd still like to use the menu system to control my system load and memory configuration. Can you tell me how to do this?

MARK MASTERS, Houston, Texas

PC MAGAZINE: The key to using DOS 6.x's multiple-configuration menu system is to start with two or more functional sets of configuration files and then merge them. Optimize each CONFIG.SYS and AUTOEXEC.BAT pair, possibly using MEMMAKER to get the most memory. Now compare the CONFIG.SYS files to see which lines are common to all and rearrange each file so that the common lines are grouped at the end.

Pick one of the CONFIG.SYS files as a starting point for your multiconfiguration system. Find the beginning of the block of lines common to all the files and insert the label [Common] just before it. Now go to the very top of the file and insert a line with a menu item name that describes this particular file—for example, [Extended]. Open another CONFIG.SYS file and extract only the lines unique to

this version. Insert the lines at the top of your growing multiconfig file and, again, precede them with an appropriate menu item name, perhaps [Expanded]. Repeat this process for each different CONFIG.SYS file.

When you're done, build the menu-definition block at the very top of your comprehensive CONFIG.SYS file. The menu block will look something like this:

```
[Menu]
MenuItem=Extended, Use Extended memory
MenuItem=Expanded, Use Expanded memory
MenuDefault=Extended, 10
```

The MenuDefault line keeps the boot process from hanging if you're not around to make a choice. If no choice is made within 10 seconds, it defaults to Extended memory and the boot process continues.

If you also use different AUTOEXEC.BAT files, start by arranging the lines of each so they fall into three groups in the following order: lines common to all configurations, lines specific to this configuration, and more common lines. At the end of the first block of common lines, insert batch commands similar to these:

```
GOTO %Config%
:Extended
...
GOTO Common
:Expanded
...
:Common
```

Clearly you'll insert the lines specific to each alternate AUTOEXEC.BAT after the corresponding label. If you build your DOS 6.x multiple-configuration menu system in this way—by merging files from fully functional alternate configurations—it should work perfectly.—Neil J. Rubenking

WORD PROCESSING

Automatically Setting a Default Printer in WP for DOS 6.0



Many PCs are connected to two printers: a laser printer for general documents and a secondary printer for special documents (a dot matrix for multipart forms or a color printer for high-end graphics). If you use the special-purpose printer during a WordPerfect session, you may forget to reset your default printer before shutting down. In all likelihood, you'll later reopen WordPerfect and inadvertently send your first print job to the special-purpose printer.

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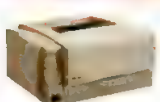
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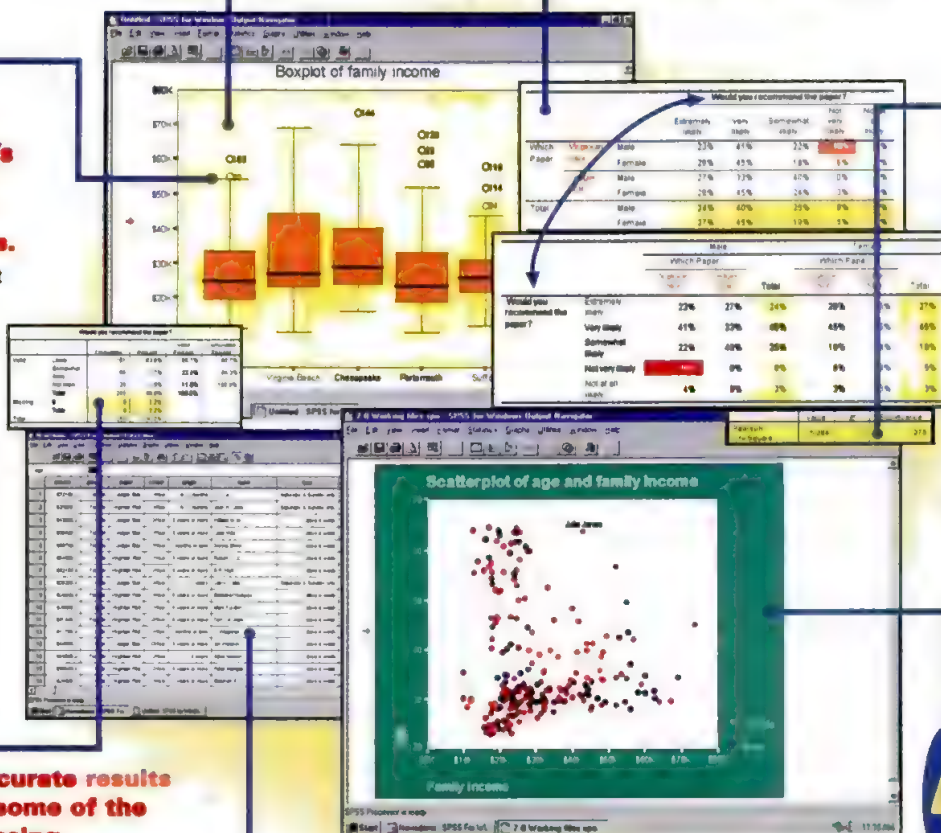
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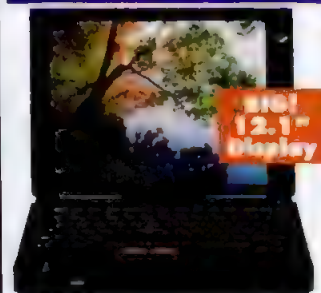
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486DX4/75	10.4" Dual Scan	720MB	3299
486DX4/75	10.4" Active	720MB	3879

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Processor	Screen	HD	Price
Pentium 90	10.4" Active	720MB	\$5349
Pentium 90	12.1" Active	720MB	6049
Pentium 120	12.1" Active	720MB	6599
Pentium 90	12.1" Active	1.2GB	7449*

*Features built-in CD-ROM drive WIN 95 models available. Call for details.



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Model	Processor	Screen	Price
Minitower	Pentium 75	1GB	\$1799
Minitower	Pentium 130	1.6GB	2299
Minitower	Pentium 120	1.6GB	2399
Minitower	Pentium 130	1.6GB	2599*
Minitower	Pentium 133	1.6GB	2899*

*16MB RAM standard Monitors priced separately



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Processor	Screen	HD	Price
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486DX4/75	10.4" Active	540MB	CALL
486DX4/75	10.4" Dual Scan	540MB	CALL*
486DX4/75	10.4" Active	540MB	CALL*

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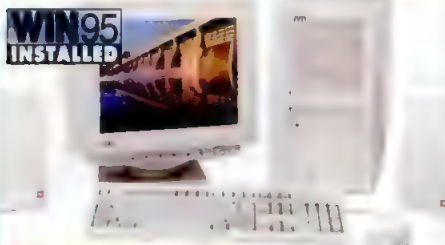
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486DX2/50	9.5" Dual Scan	340MB	\$2549
486DX2/50	9.5" Active	340MB	3079
486DX4/75	9.5" Active	340MB	3319

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Minitor (910)	Pentium 75	850MB	\$1749
Minitor (917)	Pentium 100	1.2GB	1999
Minitor (920)	Pentium 75	1.2GB	2199*
Minitor (930)	Pentium 100	1.2GB	2499*
Minitor (932)	Pentium 120	1.2GB	2599*
Minitor (940)	Pentium 133	1.2GB	2999*
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*16MB RAM standard

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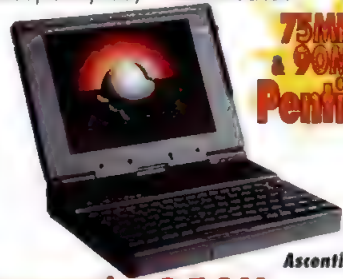
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Desktop (614)	Pentium 100	850MB	\$1889
Minitor (812)	Pentium 100	1.2GB	2089
Minitor (814)	Pentium 100	1.2GB	2379*
Minitor (816)	Pentium 133	1.6GB	2839*
Minitor (818)	Pentium 133	1.6GB	2989*

Monitors priced separately *16MB RAM standard



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Ascentia 950N

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Processor	Screen	MB	Price
Pentium 75	10.4" Dual Scan	500MB	\$2639
Pentium 75	10.4" Dual Scan	800MB	2879
Pentium 75	10.4" Dual Scan	1.2GB	3249
Pentium 75	10.4" Active	800MB	3799
Pentium 75	10.4" Active	1.2GB	4199
Pentium 90	10.4" Dual Scan	800MB	3259
Pentium 90	10.4" Dual Scan	1.2GB	3639
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Processor	Screen	MB	Price
Pentium 90	10.4" Active	1.2GB	\$5329
Pentium 90	10.4" Active	1.2GB	5889*
Pentium 120	10.4" Active	1.2GB	6539

*16MB RAM standard

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Pentium 75	10.4" Dual Scan	510MB	\$3799
Pentium 75	11.3" Dual Scan	810MB	4439
Pentium 75	10.4" Active	810MB	4729
Pentium 90	10.4" Active	810MB	5289
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Processor	Screen	MB	Price
Desktop	486DX2/66	630MB	\$1289
Desktop	Pentium 75	630MB	1589
Desktop	Pentium 75	1GB	2069
Desktop	Pentium 90	630MB	1829
Desktop	Pentium 90	1GB	2319
Minitower	Pentium 75	630MB	1629
Minitower	Pentium 75	1GB	2129
Minitower	Pentium 100	1GB	2399
Minitower	Pentium 133	1GB	2899

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Processor	Screen	MB	Price
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486DX4/75	10.4" Active	420MB	3029
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486DX4/100	10.4" Active	720MB	3499

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Processor	Screen	MB	Price
486DX4/75	10.4" Dual Scan	340MB	\$1769
486DX4/75	9.5" Active	340MB	2039

NEW!

Processor	Screen	MB	Price
Pentium 75	10.4" Dual Scan	524MB	\$2449*
Pentium 75	10.4" Dual Scan	524MB	2939
Pentium 75	10.4" Active	524MB	3519

*CD-ROM Drive is an optional accessory on this model.



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Pentium 75	10.4" Active	772MB	3999
Pentium 90	10.4" Active	1.2GB	4649

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each time WordPerfect loads. My macro points the system to an HP LaserJet Series II:

```
DISPLAY(Off!)
PrinterSelect("HP LaserJet Series
II";"HP2.PRS")
```

The first PrinterSelect field gives a printer's description, while the second field lists the name of its .PRS file. You can view the descriptions and .PRS files for each of your installed printers by selecting File | Print and clicking on Select.

To run the macro automatically at startup, load WordPerfect via the following command:

```
WP /m=macroname
```

If you use this command, your WordPerfect sessions will always have the correct default printer.

HOBART S. CABLE, II,
Alexandria, Virginia

PC MAGAZINE: This tip is helpful, but it also forces you to type in a long command line each time you start WordPerfect. You can avoid this inconvenience by one of two methods. The simplest is to create a small batch file that contains your command line. If you call the batch file WPP.BAT and place it in the same directory as WordPerfect, you can launch a correctly configured session with only a three-letter command: WPP. Alternatively, you can run your macro by adding a line to your AUTOEXEC.BAT:

```
Set WP=/m-macroname
```

Each time WordPerfect loads, it references your environment settings; this setting tells the application to run your default printer macro. Notice that you must use a hyphen rather than an equal sign between the /m command and the macro name in order to set the value of the WP variable.

Also, it may be easier to create your printer macro with WordPerfect's learn mode, which allows you to record a particular on-screen task. To begin recording, hit Ctrl-F10 and enter a macro name. After choosing File | Print (or hitting Shift-F7) and clicking on Select, identify the appropriate printer, close the two Print dialog boxes, and hit Ctrl-F10 to save the macro.—M. David Stone.

DATABASES

Open All Your FoxPro Tables at Once



We grew tired of writing "open the table" logic in every screen or batch update procedure, so we put together a simple Microsoft FoxPro routine called Opendbs. You can call Opendbs when your

application starts up, assuming you store all your tables in the same directory. You just pass it the name of your DBF directory and the routine opens all the tables in that directory.

JOHN R. MECH, Frankfort, Illinois

PC MAGAZINE: I modified Opendbs to use name expressions instead of macro substitution (it's faster) and to use the current directory if a directory isn't specified. You can run the resulting Opendbs routine (shown in Figure 2) with or without arguments. If you run it without passing an argument, like this:

```
=opendbs()
```

the routine will open all the tables in the current directory, each in its own work area. And if you run Opendbs with an argument, like this:

```
=opendbs("C:\MYAPP\DBFS")
```

it will open the tables in the C:\MYAPP\DBFS

commands to set the index order for each table.

Many FoxPro commands and functions require that you supply a name—a filename or a field name, for example. Normally, you can't use a name as a memory variable, but you can get around this by enclosing the memory variable in parentheses, thereby creating a name expression. In the Opendbs routine, for example, the lcDir memory variable contains the directory name passed to the function. When lcDir is surrounded by parentheses, FoxPro treats it as a name expression and replaces it with the value of the memory variable. Thus, if lcDir contains the value C:\VFP, the SET DEFAULT TO (lcDir) instruction becomes SET DEFAULT TO "C:\VFP".

You can accomplish the same thing using the & command to perform macro substitution. Using macro substitution, SET DEFAULT TO "&lcDir" becomes SET DEFAULT TO "C:\VFP". But FoxPro is slower at this than at evaluating name expressions, so you should

```
*****
* FUNCTION Opendbs                                     FFW 2.6 or VFP 1.0
* This function opens all databases in the requested directory.
* Sample call: =opendbs("x:\deptapps\bss")
*****
FUNCTION Opendbs
PARAMETER lcDir
lcDefault = SET("DEFAULT")+SYS(2003)      && Save the current directory
IF !EMPTY(lcDir)                          && If a directory name was passed
    SET DEFAULT TO (lcDir)                && Change to the passed directory
ENDIF
lnError = ADir(laDBs,"*.dbf")             && Build a list of DBF files
FOR lnCount = 1 TO ALEN(laDBs,1)          && For every file in the list
    lnAt = AT(".",laDBs[lnCount,1]) - 1   && Calc the length of the
                                          && filename portion only
    lcAlias = LEFT(laDBs[lnCount,1],lnAt) && Extract the filename
    IF !USED(lcAlias)                     && If that alias is not open
        USE (laDBs[lnCount,1]) IN 0       && Open the table in a new area
        WAIT WINDOW RTRIM(laDBs[lnCount,1])+" opened" NOWAIT
    ENDIF
ENDIF
ENDFOR
SET DEFAULT TO (lcDefault)                && Change back to the saved dir
WAIT CLEAR
RETURN
```

FIGURE 2: You can use the Opendbs function to open all the FoxPro tables in a directory at once, each in its own work area.

directory; again, each table will open in its own work area.

It's a common practice to store all tables in the same directory, and the Opendbs routine provides an easy way to open all of them at once. Note that each table is opened in physical record order (the order in which you entered the records). So, if a table has an accompanying compound index file (.CDX), the index file will be opened but the index order won't be set, defaulting instead to physical record order. You might want to follow the Opendbs routine with a series of

use the latter whenever possible. Of course, name expressions are restricted to passing character strings as names (filenames, menu names, window names, and so forth). To pass a keyword as a character string, you must use macro substitution.

Before opening each table, the Opendbs function checks to see if a table with that alias is already open, making the assumption that the table's filename is the alias in question. Thus, if a table is named Customer.DBF, the routine looks for an open table with the Customer alias. If, however, the table was opened

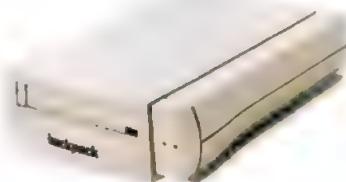
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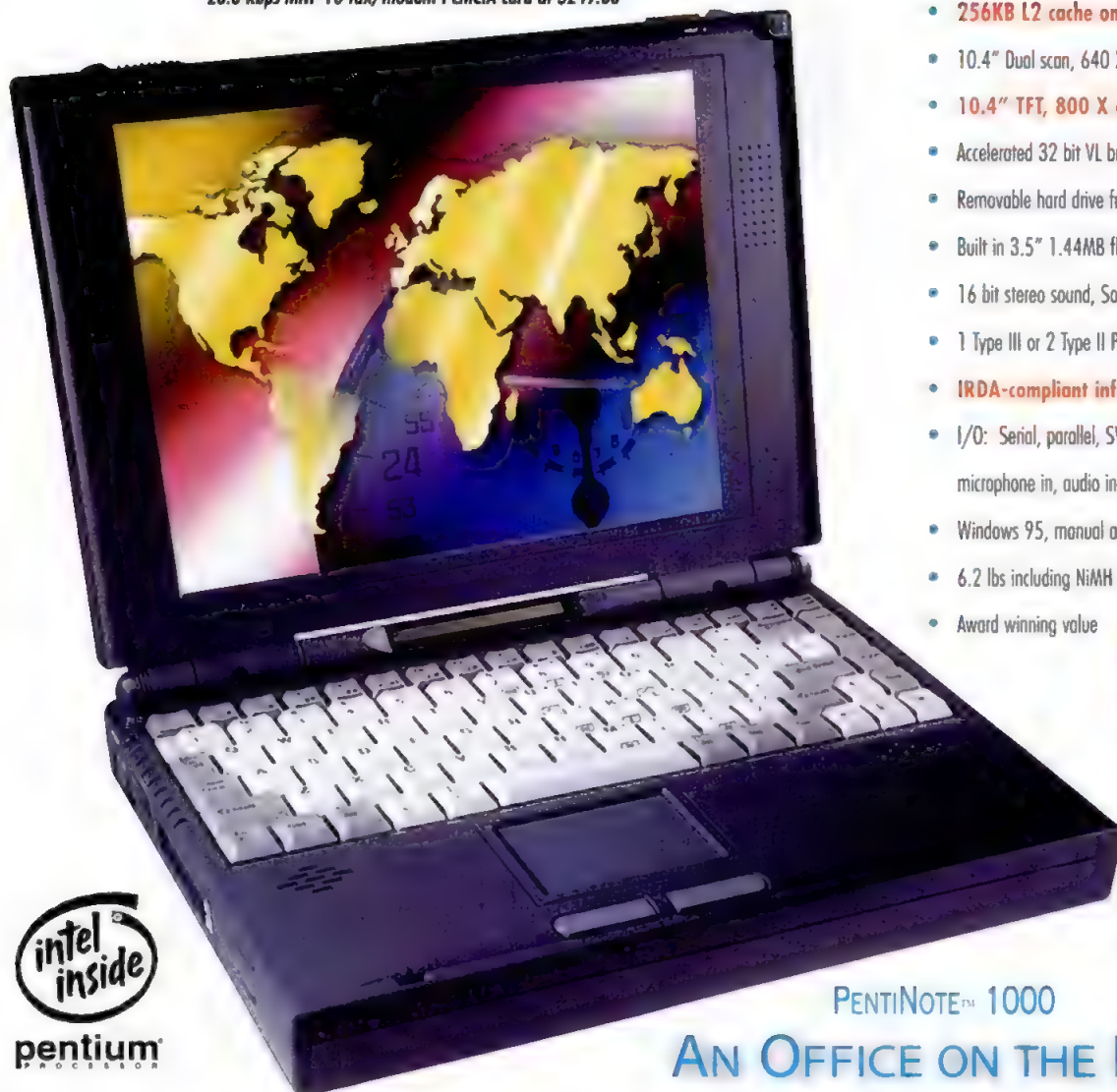
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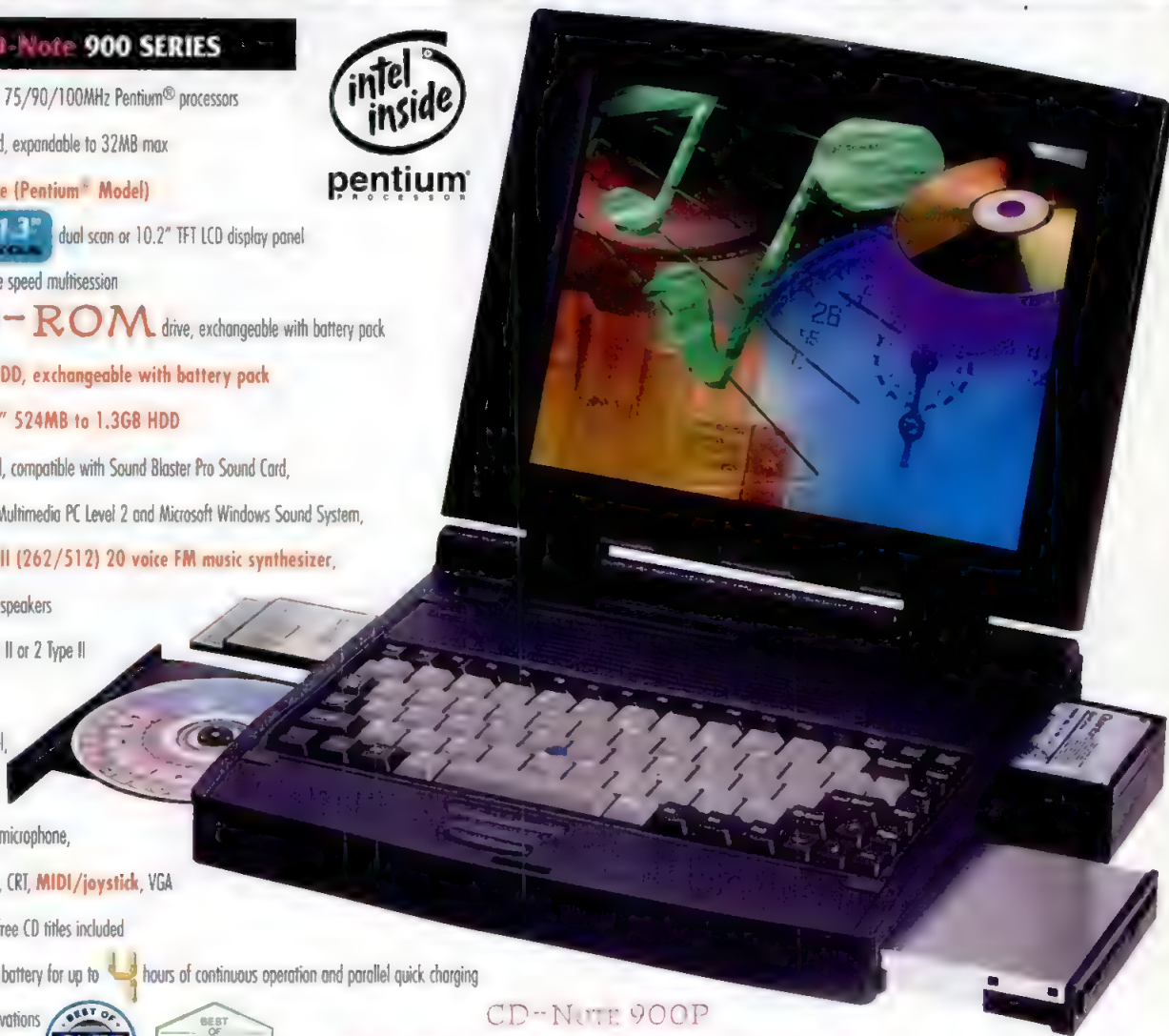
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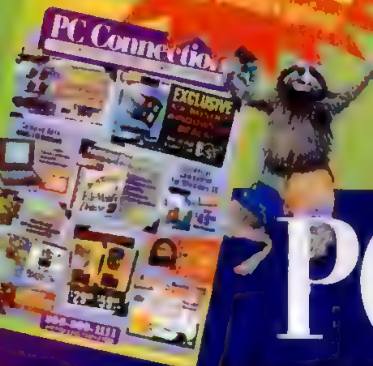
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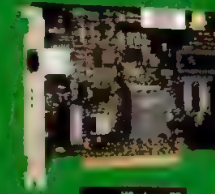
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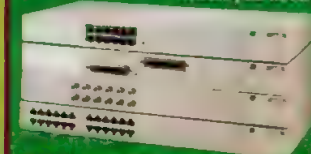


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with a different alias (Cust, for example), Opendbs won't detect it. In this case, when the function attempts to open the Customer.DBF file again, it will fail.

Of course, it may well be the case that your alias names are not the same as your filenames, since FoxPro lets you use any alias you like. Still, the flaw resulting from Opendbs's assumption isn't serious if you use Opendbs as

translucent patterns that are visible only when you hold a sheet of paper up to the light. Designers who use computers can produce similar effects using very light shades of gray or colored tints.

Microsoft Publisher's WordArt module, which is actually a small OLE engine for creating text effects, can easily produce the watermark you describe. Just follow these steps:

1. Select the WordArt tool and draw a frame that's as large as you want the watermark to be.
2. When the WordArt dialog box appears, enter the word COPY.
3. Use the WordArt toolbar to assign the following attributes:

- **Slant Up More** (from the Shape drop-down list): This produces text rotated to a 45-degree angle, as Figure 3 shows.
- **Arial**, or another appropriate typeface.
- **Best Fit**: When you choose this instead of an explicit point size, Publisher

resizes the text to fit your frame.

- **Boldfacing**.
 - **Silver** (from the Shading dialog box): Silver is the lightest gray shade WordArt can produce.
4. Click anywhere outside the WordArt frame to return to your document.

By the time you read this, Microsoft will be shipping Publisher 3.0. These instructions will work with either Publisher 2.0 or 3.0, because the WordArt module hasn't changed. But there are a few important improvements in Publisher 3.0. The new version of the program supports true rotation, so you can create either a horizontal WordArt element or a normal text object and rotate the entire frame 45 degrees. Publisher 3.0 also lets you create true tints of black. So instead of silver (which is about 30 percent gray), you can specify exactly the shade of gray you want. I've found that a 10-percent gray works very well as a watermark, because it allows the rest of the text in a letter or invoice to remain distinct.

Getting the invoice or letter to surprint the watermark is a little trickier. *Surprinting* is a printer's term for printing one element over another. First, you must check the stacking order of the objects in your document. If the WordArt frame is on top of the text frame that contains the invoice, the text in the invoice will be forced to wrap around the watermark. To surprint the invoice on the watermark, make sure that the WordArt frame is positioned behind the text frame. The issue

of text wrap is even more crucial if you're working with Publisher 3.0 and decide to create this effect using standard text frames. No matter how you stack the objects, you'll always have a text frame on the bottom of the stack—and the text will always wrap instead of surprint.

To avoid the problem altogether, you can place the watermark on the Background page. Publisher's Background page is a special area that typically contains those elements—page numbers, for example—that repeat on every page of a multiple-page document. In this case, however, placing the watermark on the Background page offers other advantages. Objects in the background don't interact with objects in the foreground, so the text will always surprint on the watermark. And, you can easily turn the background off and on. Turning the background off hides the word COPY, allowing you to print an original invoice. Turning the background on displays the word COPY, enabling you to print a duplicate invoice.

Note that, by default, Publisher always creates text frames with an opaque white fill. Since the text frame must be on top of the stack, it will obscure the watermark beneath it. The solution is simply to make the text frame transparent. Use the Ctrl-T shortcut or choose the transparent option (indicated by a null symbol) from the Shading dialog box.

Perhaps the best reason to use WordArt is the fact that it is an OLE server. Once it is installed on your system, you can use WordArt with any OLE-compliant application. For example, you can use Excel to create your invoices, and you can then invoke WordArt from within Excel to insert the word COPY into your invoices. This provides the benefits of both WordArt's design functions and Excel's math functions. □

—Luisa Simone

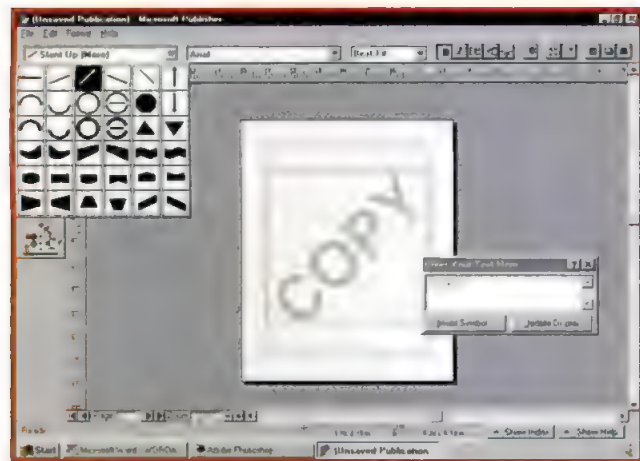


FIGURE 3: The *Slant Up More* option in Microsoft Publisher's WordArt module produces text rotated to a 45-degree angle.

it was intended: early in your startup logic when all tables are closed and all work areas free and available. You may even want to precede the function with the CLOSE DATABASES ALL command.

You can download the Opendbs routine from PC Magazine Online. See the sidebar "Guide to Our Utilities" for instructions. Look for the file OPENDBS.PRG.

—Sal Ricciardi

GRAPHICS

Creating a Watermark in MS Publisher



Sometimes I need to send clients a duplicate of an invoice or other correspondence, and I'd like them to know it is a duplicate and not the original. So I'd like to create a document with the word COPY in large type slanting across the page. The word should print in light gray so that a letter or invoice could be typed over it.

I use Microsoft Publisher 2.0, but so far I haven't been able to create this effect with Publisher's WordArt. Can you help?

BILL HEBBLI, Fort Wayne, Indiana

PC MAGAZINE: This type of design—a light gray motif or pattern over which you can legibly print text—is known as a watermark. Traditionally, watermarks are created as part of the papermaking process. They are

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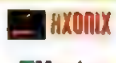
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4.3 GB Barracuda 8 ms Seek 5400 RPM 1024K Buffer	1210	1270
2.5 GB Fast & Wide Barracuda 2 8 ms Seek 7200 RPM 128K Buffer	930	990
4.3 GB Fast & Wide Barracuda 4 8 ms Seek 7200 RPM 128K Buffer	1285	1345
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DLT4000	40GB	3MB/sec	DLT40	6295

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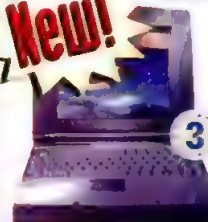
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950N	Pentium/75	8MB	10.4" Dual Scan	800MB	\$2,839
950N	Pentium/75	8MB	10.4" Dual Scan	1.2GB	\$3,209
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Versa 2000C	486DX4/75	8MB	9.5" Active	540MB	\$2,604
Versa 4000D	Pentium/75	8MB	10.4" Dual Scan	540MB	\$3,255
Versa 4000D	Pentium/75	8MB	10.4" Dual Scan	540MB	\$3,576
Versa 4000C	Pentium/75	8MB	10.1" Active	540MB	\$3,720
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Extensa 550CD	Pentium/75	8MB	10.4" Dual Scan	524MB	\$2,865
Extensa 550CD	Pentium/75	8MB	10.4" Active	524MB	\$3,442
TMS5000	Pentium/75	8MB	10.5" Dual Scan	500MB	\$2,929
TMS5000	Pentium/75	8MB	10.4" Active	772MB	\$4,017
TMS100	Pentium/90	8MB	10.4" Active	1.2GB	\$4,660
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SuperScan Pro 21

21-inch, digitally-controlled, fully-featured, multi-scanning color monitor



- 21" flat, square screen color monitor
- 28 mm dot pitch
- Supports VGA up to 1600 x 1200 @ 66Hz
- Digital, microprocessor controls
- Easy Menu™ on screen programming
- Dual dynamic focus, anti-static/anti-glare, VR coating, Invar mask
- Low radiation, MPRII compliant, Energy Star

SuperScan Elite 21

Same as above but supports 1600x1200 at 76Hz refresh, plus higher refresh rates at all lower resolutions

\$1795

\$1925

SuperScan Supreme 21

Same as above but supports 1600x1200 at 86Hz refresh, plus higher refresh rates at all lower resolutions, 26mm dot pitch, Windows 95 Plug and Play

\$2325

CAT Blueprint Scanner

Scans 22" x 34" drawings!



- CAT redefines affordability for large document scanning
- Large documents can be quickly and easily scanned in for editing or touch up, compressed and stored for archiving, or converted to vector format for CAD applications (using optional vectorization software)

CAT Blueprint E Size

\$1875

Draftsman Plus LF w/ CAT purchase

\$1645

- Raster to Vector Software, LF-support up to 100"x100" at 300 dpi



Draftsman PLUS HS

Raster-to-Vector conversion that works!

- Heads up digitizing
- Raster to Vector Conversion
- Hybrid Raster/Vector Printing
- Supports PCX, RLC, CALS4 and TIF raster formats
- Supports 300 dpi scans up to 6 1/2" wide

Draftsman PLUS PF

\$795

Draftsman PLUS LF

\$1695

- Supports 300 dpi scans up to 100"x100"

CalComp

DrawingBoard III 12 x 12

NEW! Corded or cordless! Same price!



- 12x12 Digitizing Tablet with 16 button puck
- Resolution up to 2540 lpi; .010 inch accuracy
- ADI, MS Windows compatible, MS Mouse emulation

DrawingBoard III 12x18

\$359

Scanners

Microtek

ScanMaker II	\$399
ScanMaker IISP	\$469
ScanMaker IISPX	\$625
ScanMaker IIHR	\$550
ScanMaker IIHR Full Photo	\$749

Mustek

Paragon 600 IISP	\$399
Paragon 1200 Ic	\$499
Paragon Office	\$549
Paragon 800SP	\$499

PlusTek

PageReader 800	\$169
ScanPlus Color	\$249
ScanPlus FX	\$399

Relisys

Web Office Pro	\$449
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Great features, great software, great price

- 24-bit, 16.8 million colors

- 8 1/2" x 14" scan area
- 600x300 dpi optical
- Software included: Photo Studio, Text Bridge

Papermaster and Cypherscan	
Reli-a840T	\$1099
Reli 9612T	\$999
Reli 9624T w/3.0	\$1299

Digitizers

CalComp

DrawingBoard III 12x12	\$225
DrawingBoard III 12x18	\$359
DrawingSlate II 4x5	\$145
DrawingSlate II 6x9	\$195
DrawingSlate II 12x12	\$225

SummaGraphics

Summasketch III 12x12	\$215
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- 4 button cursor

- 2450 lpi;
- .010 accuracy
- ADI, MS Windows,
- MS mouse emulation

Summasketch III 12x18	\$309
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Wacom

ArtPad II 4 x 5	\$145
ArtPad II 4 x 5 with Dabblor	\$169
ArtZ II 6 x 9 Graphic Tablet	\$319
ArtZ II 12 x 12	\$429

Plotters

CalComp

Designmate 3024s A-D size	\$1275
Designmate 3036s A-E size	\$1739
TechJet Personal	\$565
TechJet Designer 720 A-D	\$2175
TechJet Designer 720 E size	\$2775
TechJet Color A-D size	\$3995
TechJet Color A-E size	\$4495

HI/Summagraphics

DMP 161 A-D size	\$1249
DMP 162 A-E size	\$1859
DMP 162R roll feed	\$2045
HiPlot 7100 A-D size	\$1485
HiPlot 7200 A-E size	\$2045
JetPlot A-C size inkjet	\$1045
Summajet Mono A-D size	\$1875
Summajet Mono A-E size	\$2375
Summajet Color A-D size	\$2095
Summajet Color A-E size	\$2595

Monitors

Hitachi NSA

17" Elite - CM1711	\$849
20" Pro - CM2011	\$1279
20" Elite - CM2098	\$1579
21" Elite - CM2111	\$1925
21" Supreme - CM2112	\$2425

iiyama

MF 861TE - New!	\$729
MF 901TE - New!	\$859

LCD Panels

nView

nViewZ 110	\$3159
nViewZ 115	\$3499

5 Star Service

- ★ ★ ★ ★ ★

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MICROTEK

ScanMaker IISPX

Single Pass Color Scanner with Full Photoshop 3.0!

\$625



- 24-bit scanner captures over 16.7 million colors
- 600x300 dpi resolution, 1200x1200 interpolated
- 8.5 x 11.67" scan frame
- Full Photoshop 3.0 and OmniPage Direct OCR
- Won PC Magazine's Editors' Choice Award

ScanMaker IISP

- With ImageStar and OmniPage

\$469

ScanMaker III

36-bit single pass scanner captures 68 billion colors!

\$1989



- 1200x600 dpi optical res., 2400x2400 interpolated
- Full Photoshop 3.0, Scan Wizard, and DCR color calibration software, and OmniPage Direct OCR
- Dynamic range near 3.4 for vastly increased detail
- Bonus: In

Full Photoshop 3.0, Scan Wizard, and DCR color calibration software, and OmniPage Direct OCR

Dynamic range near 3.4 for vastly increased detail

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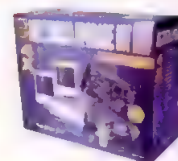
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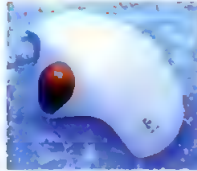
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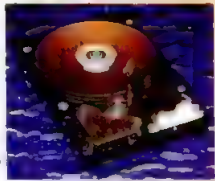


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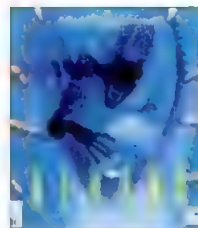
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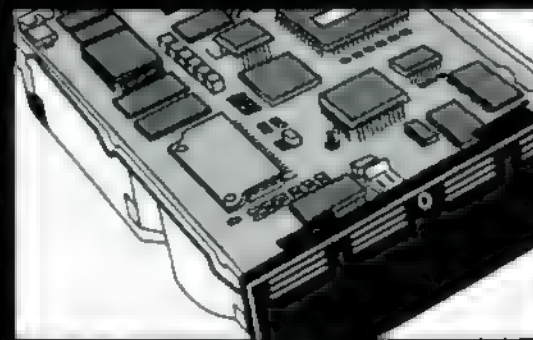
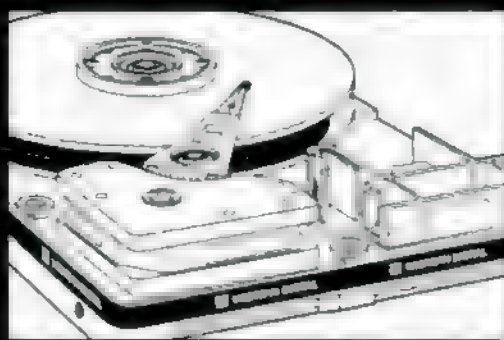
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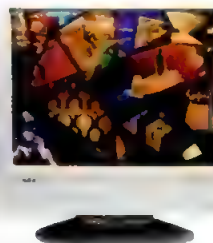
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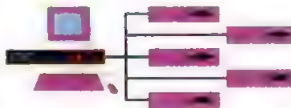
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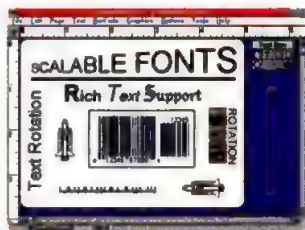
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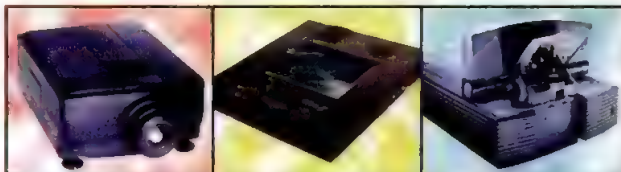
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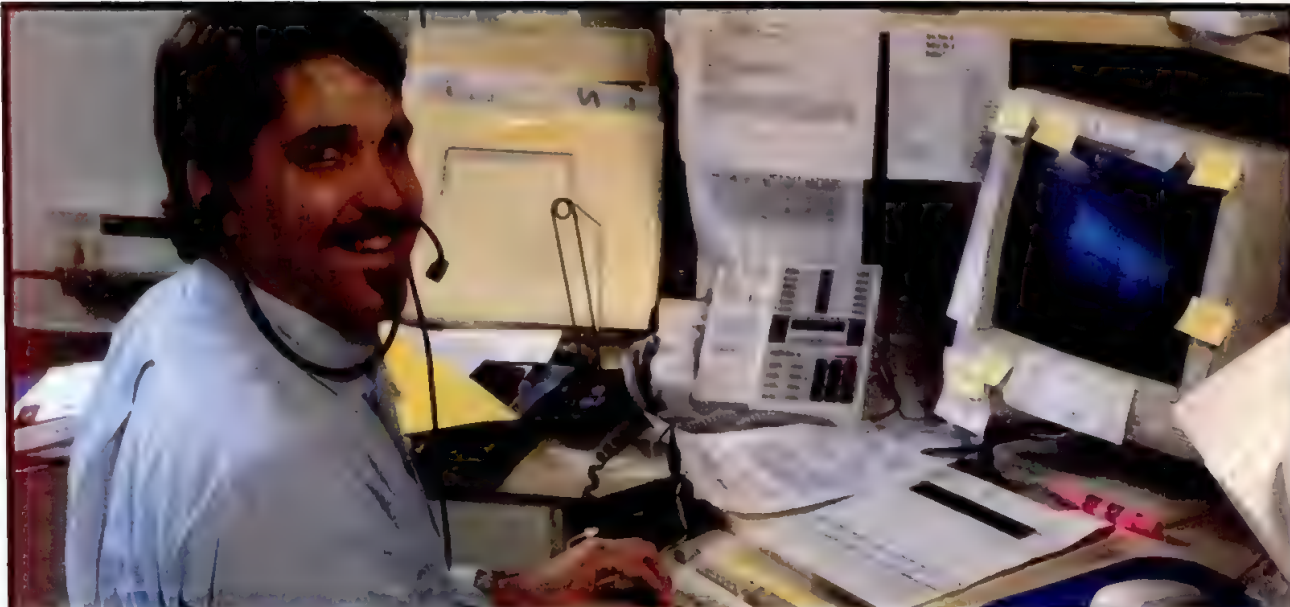
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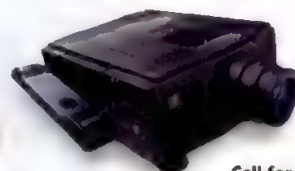
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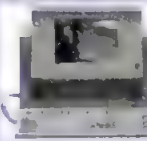
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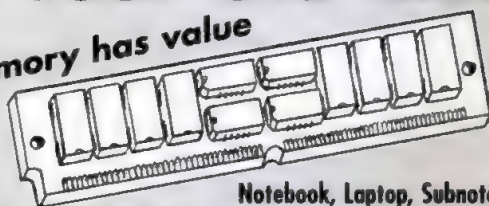
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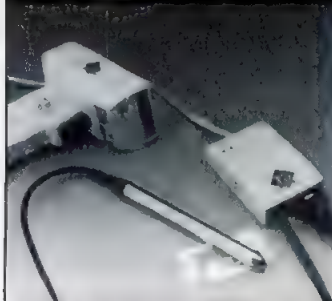
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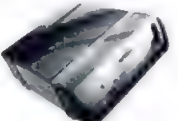


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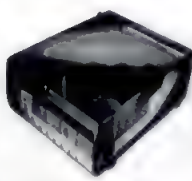
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10. ☐ Laser Printers
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22. ☐ Groupware
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working

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Cards
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41. ☐ FDDI

42. ☐ Video Conferencing
43. ☐ On-Line Services
44. ☐ Telephony

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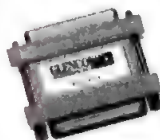
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PC MAGAZINE
AT HOME

101 REASONS TO CELEBRATE

The holidays are fast approaching, and this truly is the most wonderful time of the year. But if you're still faced with tons of folks who need gifting, and no idea what to buy them, how can you get in the holiday spirit? Don't despair: Your shopping list may be long, but our list of gift ideas is bound to be longer. We've gathered 101 of the best educational and entertainment products to hit the shelves since last holiday season. Nearly all of these products are Windows-based, except for the games, most of which run under DOS.

For the youngest folks on your list, our Kids' Software section includes a selection of learning games covering all the basic subject areas, many of



By Gayle C. Ehrenman

of PC peripherals that would look great on any desktop. Finally, we've included a list of ten great gifts under \$35.

You don't have to fret over your shopping list any longer, for we've given you 101 reasons to celebrate this holiday season.

which star characters the kids will recognize.

For those hard-to-please gamers, this holiday offers an abundance of riches in all categories: action and adventure games, arcade games and puzzles, strategy and simulation games, and sports games.

Looking for something a bit less frivolous? Then check out the reference offerings and our selection of personal productivity software. For gadget lovers, we have a fun and funky array



KIDS' SOFTWARE

Software for Children of All Ages

Kids' software should be educational, captivating, and challenging. But above all, it should be fun. Here's a collection of titles that meet each of these criteria for nearly any age group.

**Ages
3-6**

LOOKING TO GIVE your kids a head start in school?

Jumpstart Preschool

(\$40 estimated street price; Knowledge Adventure, 800-542-4240) gives your little one

a learning boost with friendly helpers who guide them through ten activities. Games such as connect the dots and hide-and-seek help kids identify shapes, colors, numbers, letters, and sounds. Pierre the

Bear and Casey the cat speak all the directions, so parents can set the manual down long enough to join in.

If your kids are as fascinated by airports as most, you can take them behind the scenes with **The Airport** (\$29.95 list; Humongous Entertainment, 800-449-8386). No dry definitions here. Rather, this animated encyclopedia of a modern air terminal features brightly colored scenes of everything from airplane hangars to helicopter rotors. The purpose of each sophisticated item is made clear in language kids can understand.

Back on the ground, kids will be glad to see their favorite purple car return for



TRUDY'S TIME AND PLACE



PUTT PUTT SAVES THE ZOO

another interactive adventure in **Putt Putt Saves the Zoo** (\$40 street; Humongous Entertainment, 800-449-8386). Our four-wheeled friend

HOLIDAY GIFT GUIDE INDEX

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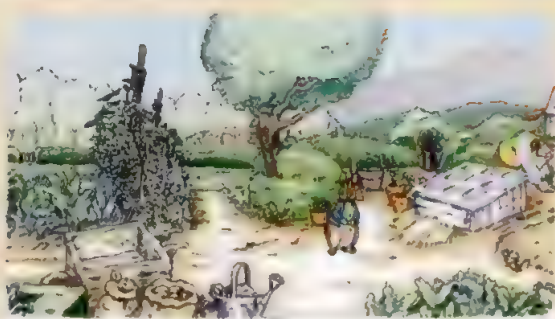
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AND then, feeling rather sick, he went to look for some puzzles.



THE ADVENTURES OF PETER RABBIT AND BENJAMIN BUNNY

must return several animal pals to their parents so that the Car Town zoo can open on time. Great characters and puzzles make this another winner from the Putt Putt gang.

Treat your kids to an old favorite with **Dr. Seuss's ABCs** (\$40 street; Living Books, 800-397-4240). Theodore Giesel's whimsical world of Zizzer Zazzer Zuzz and Aunt Annie's alligator springs to life in this interactive storybook that expands on the classic tale with added dialog and songs in the Seuss tradition. Kids can listen to the entire story, or select a letter of the alphabet to move to a specific page. A sing-along option lets children belt out the ABC song with the Seuss characters.

Another classic author, Beatrix Potter, comes to the PC in **The Adventures of Peter Rabbit and Benjamin Bunny** (\$35 street; Mindscape, 800-234-3088). Splendid illustrations, friendly narration, and a wide-open world of discovery capture the flavor of this classic tale. Innovative techniques not possible with paper illustrations (like a 360-

degree panoramic view) will draw kids into Peter's world. Youngsters can also print screens, which they can then color.

You can help your kids learn about time and geography with **Trudy's Time and Place** (\$40 street; Edmark, 800-691-2985). An excellent, child-friendly design patiently explains the relationship between the digital and analog clocks kids see around the house by letting them set the time. Another feature of the game sends kids off in a spaceship to get a Hubble's-eye view of continents and oceans.

Ages 6-10

TURN YOUR HOME PC into a creativity machine with

Kid Works Deluxe

(\$50 street; Davidson & Associates, 800-545-7677). Young writers can experiment and invent by mixing pictures, sounds, illustrations, and animation to form original stories. If your kids don't know where to start, the program has more than 100 story-starter ideas to get them going. This package even lets kids share their stories with friends

and relatives over the Internet.

Magic potions, spooky castles, giant spiders—just the stuff to get your third-grader interested in grammar lessons. They're all part of **I.M. Meen** (\$49.95 list; Simon & Schuster Interactive, 800-983-5333), a 3-D maze game that calls for quick thinking and a mastery of basic writing skills, such as punctuation and capitalization.

Language skills also play a central role in **Action Reading: Kenny Kite to the Rescue** (\$34 street; Conexus/Davidson & Associates, 800-545-7677). When a call for help comes in on the telephone, kids direct Kenny Kite to the problem. Following the written instructions and the narrated cues, kids help with such problems as repairing a bicycle. Kenny's lessons can help prepare elementary-school students for the challenges of middle school and beyond.

In **James Discovers Math** (\$40 street; Broderbund, 800-521-6263), young number crunchers find math problems all over James's kitchen. Engaging activities include making pictures from the geometrically shaped magnets on the family fridge and filling grocery orders. Top-notch animation, catchy music, and clearly narrated directions help beginning mathematicians get a grip on real-world math.

Bugs may be drawn to kitchens, but kids are definitely drawn to bugs. **The**

FEATURE PLUS

From December 4 to 8, get some holiday gift ideas from **PC Magazine** associate editor Michael Ryan and representatives from the CD publishers mentioned here. Type **GO EXEC** from any ComputerServe prompt.

Multimedia Bug Book (\$50 street; Workman/Swift, 800-237-9383), gives elementary entomologists the chance to find, collect, and study more than 50 insects through video clips, photographs, and illustrations. With several activities that kids can perform away from the computer, this is an excellent science program.

What youngster wouldn't love a field trip to the ocean in a

bus that doubles as a submarine? That what's in store on board **The Magic Schoolbus Visits the Ocean** (\$45 street; Microsoft, 800-426-9400). From the driver's seat, kids can launch an undersea treasure hunt. All the while, they learn about the ocean and shoreline eco-systems. It's not just all dry science, though. Kids can also build sand castles and help guide a small fish back to the ocean at low tide,

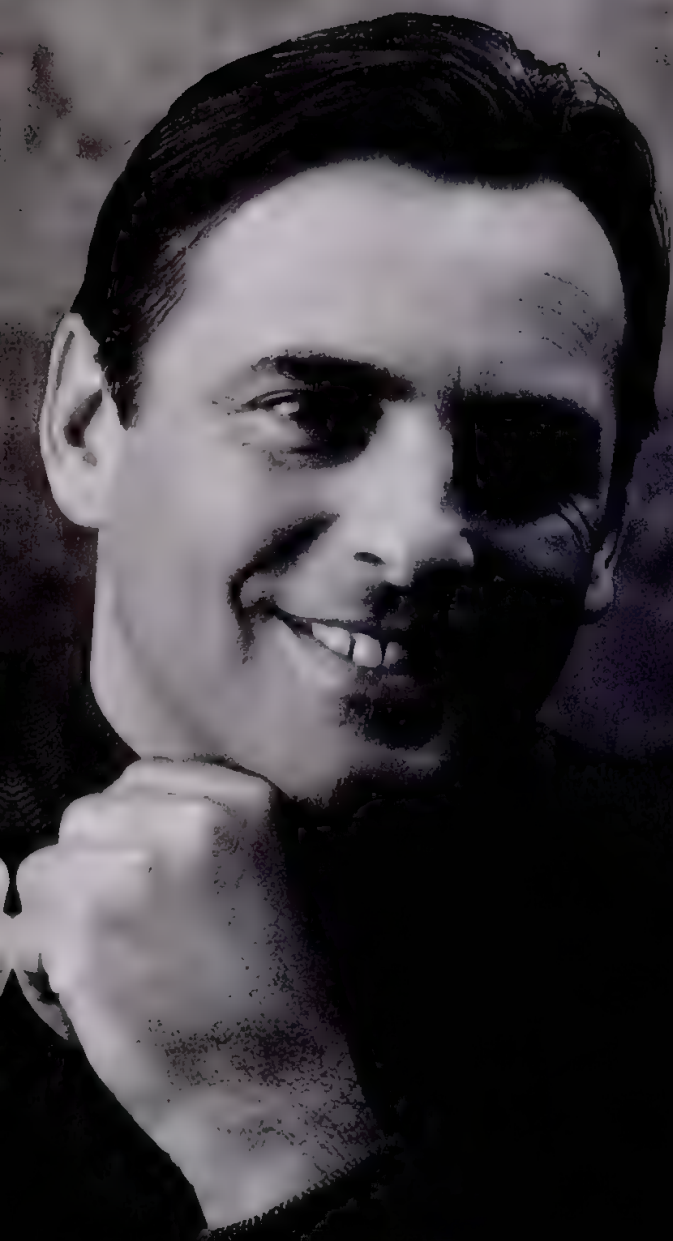


KID WORKS DELUXE

among other activities.

Parents eager to keep their kids' learning skills up to par over extended holidays will welcome **Adi's Comprehensive Learning System** (\$44.95 list, per module; Sierra On-Line, 800-757-7707). This impressive, integrated collection of educational toys and games is

*I trade
soybeans*



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With my new Acer[®] Aspire[™] Desktop, I can take on Wall Street
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The 28.8kbps fax modem¹ and speakerphone

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help me cut deals over the phone or online.

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Order out for pizza.

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Aspire includes 50 preloaded software and reference titles.

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Plus, the five-speed CD-ROM¹ drive, AuraSound[™] 3-D stereo

Lower my handicap.

speakers and accelerated graphics are terrific for multimedia.

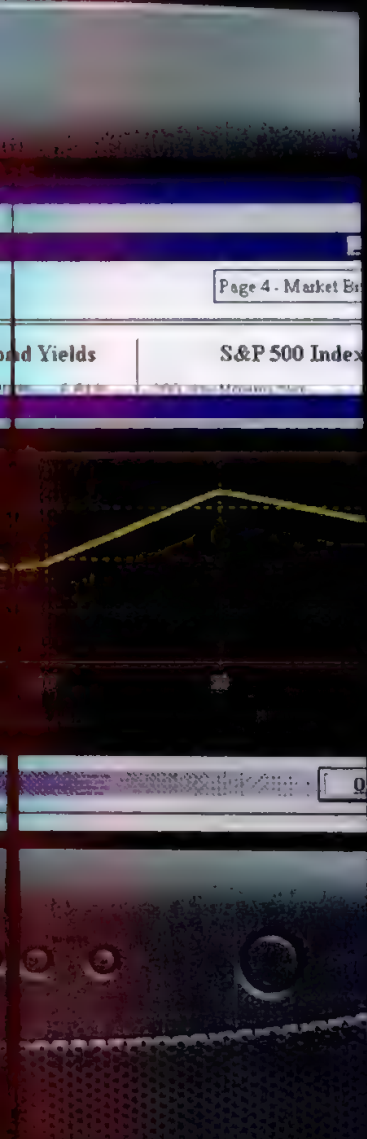
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Aspire Desktops

Processor Choices

- 486DX4/100
- Intel Pentium processor

System Memory

- 8MB system memory; expandable to 128MB**

Expansion

- Two PCI slots**
- Two ISA slots (three on DX4/100 models)
- One shared by PCI and ISA**

Modem

- 14.4kbps fax modem

Mass Storage

- 540MB to 1GB hard drives

Aspire Minitowers

Processor

- Intel Pentium processor

System Memory

- 8MB system memory; expandable to 128MB

Cache

- 256KB second-level cache

Expansion

- Three PCI slots
- Four ISA slots
- One shared by PCI and ISA

Devices/Bays

- Three additional expansion bays

Modem

- 28.8kbps fax modem

Mass Storage

- 1GB to 1.6GB hard drives

All Aspire systems include:

Graphics

- Accelerated graphics with 1MB video memory, expandable to 2MB
- Full-motion video acceleration hardware supports software MPEG video playback

Multimedia Features

- Sound Blaster™-compatible 16-bit stereo sound card
- Up to 44.1kHz sampling rate
- Five-channel stereo mixer
- Joystick/MIDI port
- Quad-speed CD-ROM on most models

Modem

- Two modem telephone jacks
- Fax modem with telephone answering machine/voice mail
- Full-duplex speakerphone

Devices/Bays

- One 3.5" hard disk drive
- One 3.5" 1.44MB diskette drive
- CD-ROM drive in 5.25" bay

Warranty

- Three-year limited warranty; first-year on-site service; second and third years Carry-in or Mail-in

Software

- 50 preloaded software and reference titles (a \$1700†† value)



Aspire Monitors

Screen Sizes

- 14", 15", and 17" color monitors with viewable images of 13.1", 13.6" and 15.7" respectively

Dot Pitch

- .28mm

Resolution Support

- 14" Aspire 33s: 800 x 600 and 640 x 480 and all VGA modes
- 15" Aspire 56s: 1024 x 768 at 75Hz, 800 x 600 at 72Hz, 640 x 480 and all VGA modes
- 17" Aspire 76is: 1280 x 1024 at 60Hz, 1024 x 768 at 75Hz

Front-Panel Controls

- 14" features analog controls
- 15" and 17" feature digital controls

On-Screen Functions

- 17" monitor features on-screen controls

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- Up to six watts/channel, stereo speakers
- Unidirectional microphone

Warranty

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1995 Holiday Gift Guide

designed to keep kids interested and learning. Adi, a friendly alien, directs kids through exercises in math, English, and science, while also providing plenty of room



THE MULTIMEDIA BUG BOOK

for drawing, painting, and other creative play. Kids earn points by completing lessons; they redeem the points to play games. Few learning programs are as comprehensive and well designed as this one.

**Ages
10+**

INTEGRATED programs that give older kids learning and creativity tools aren't new, but links to on-line communications are a welcome twist. **Perfect Works for Kids** (\$49.95 list; Novell, 800-451-5151) covers everything from drawing and painting to writing and e-mail. Kids pick the tool they need from a virtual desk, which parents can customize for each child in the family. For sharing files and further research, the program links to America Online. Concerned parents can set the program so that it allows access only to the kids' section of the service.

Another school tool, **Student Writing & Research Center** (\$99 list; The Learning Company, 800-852-2255), gives students in middle school and high school a powerful and easy-to-use word processor. As a bonus, the program's electronic version of Comp-

ton's Concise Encyclopedia is a worthwhile resource. Even if the student at your house has no idea what to write about—a common complaint—he or she can use the Encyclopedia's idea search tool to develop a topic. Pictures, tables, and quotes from the Encyclopedia can be easily copied to the document, complete with suitable attribution.

Cool graphics surround brainteasers, mazes, and tons of puzzles in the search for **The Lost Mind of Dr. Brain** (\$49.95 list; Sierra On-Line, 800-757-7707). While conducting an experiment, our poor professor transferred his mind into the head of his pet mouse. The only way to restore it is to complete a series of puzzles that encourages players to use different strategies to solve the game's problems. Each completed puzzle brings a piece of brain back to the absentminded professor and explains basic facts about brain functions.

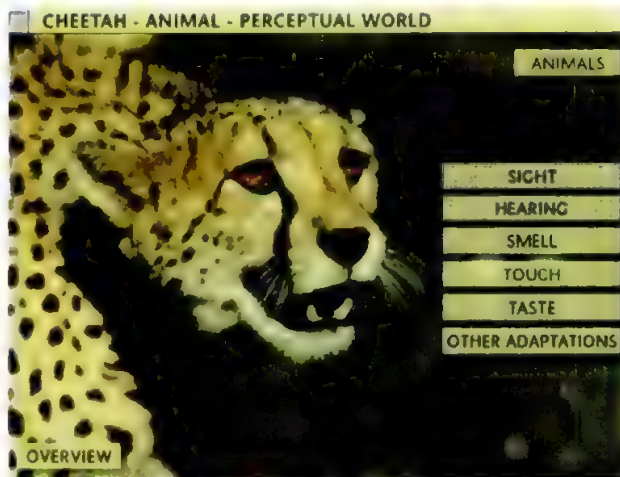
Sports demand a special brand of intelligence, especially in a game like **NFL Math** (\$39.95 list; Sanctuary Woods, 800-943-3664). In this scrim-

mage designed to boost arithmetic skills, kids choose an NFL team to control, then select plays to run during the game. The success of the play depends on how well kids answer the math problems posed to them during the huddle.

For more down-to-earth lessons, your kids can set off on a continentwide virtual bi-

different African cultures. Based on a real-life cycling trip, and using top-notch photography, video clips, and sound effects, **Africa Trail** is a great learning adventure.

To get an even more in-depth lesson in environmental awareness, try **Total Biopark** (\$39.95 list; Computer Curriculum, 800-983-5333). Inter-



TOTAL BIOPARK

cycle trek in **Africa Trail** (\$48 street; MECC, 800-685-6322). As they make their way across Africa, kids have to keep a close eye on the road and their supplies. But all the work is worth it when they start meeting and exploring

ested students can explore the habitats and habits of six different species: rattlesnake, prairie dog, octopus, pigeon, cheetah, and spider. Each of these creatures provides tons of information on a specific environmental landscape and ecosystem.

High-school juniors and seniors facing the college decision would do well to peruse a copy of **On Campus 96** (\$50 street; Kaplan Interactive, 800-527-4836). This five-disc set covers more than 1,700 colleges and universities. All of the included schools supply information about financial aid and application requirements, and some include video clips or campus maps. Students can search for a school using a variety of criteria, such as degree programs.—*Peter Scisco*



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tuner DTV 1100 Series converts broadcast video or cable signals into a live TV window right on your PC screen. What's more, the Stealth64 Video 2001 Series packs a serious punch for Windows® 95, Windows® 3.1 and DOS multimedia applications. For outstanding graphics and video with an integrated TV tuner, check out the Stealth64 Video 2001TV Series. Both products feature Plug-and-Play support and Diamond InControl Tools for easy set-up and enhanced productivity. You'll never miss out on the action with a 5-year warranty, 24-hour fax-on-demand, and on-line support services. So, if you're interested in desk-shattering acceleration, no compromise graphics, and dazzling video performance—all at a price that'll make your head spin, call Diamond Multimedia at **1-800-4-MULTIMEDIA** for more information today.



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Stealth64 Video 2201	• 2MB DRAM
Stealth64 Video 2121TV	• 1MB (expandable to 2MB) DRAM
Stealth64 Video 2201TV	• 2MB DRAM
Controller	S3 Trio64V+
Vertical refresh	Up to 120Hz
Max resolution	1280 x 1024
Bus type	PCI
Optional hardware	• MPEG Video Player 1100 daughtercard • DTV 1100 TV tuner card — 2121, 2201
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GAMES/ACTION AND ADVENTURE

Games for Quick Reflexes and Sharp Minds

Games always make great gifts during the holiday season. To help narrow your shopping list, we've looked at 40 of this season's absolute best.

EVEN THOUGH IT'S BEEN available since the beginning of 1995, **Wing Commander III** (\$55 street; Origin Systems, 512-434-4263) is still state-of-the-art thanks to its texture-mapped SVGA graphics and spectacular space combat action. And even all that takes a back seat to the full-motion video sequences, with performances from Mark Hamill and other familiar faces.

For a more lighthearted approach to dueling starfighters, try **Descent** (\$39.95 list; Interplay Productions, 714-553-6655). This first-person shooter pits you against a horde of nasty robots and goes DOOM one step better by providing a vertigo-inducing, 360-degree range of motion. There's even modem and network play.

Dark Forces (\$45 street; LucasArts Entertainment Co., 800-985-8227) is another first-person action game, this one set in the *Star Wars* universe. You play a reluctant hero who fights off Imperial storm troopers in a series of missions. With cinematic sound effects, great music, and waves of bad guys to mow down,

Dark Forces is loads of fun.

For even more DOOM-like action, make sure you give **Hexen: Beyond Heretic** (\$50 street; GT Interactive, 800-610-4847) a good long look. In this sequel to *Heretic*, you choose your character class, cast spells, smash objects, and battle demons with 12 different weapons. The graphics are outstanding and the environments are incredibly detailed.

For shoot-'em-up action with a twist, check out **Crusader: No Remorse** (\$50 street; Origin Systems, 512-434-4263).



CRUSADER: NO REMORSE

Instead of a first-person perspective, *Crusader* gives you an overhead, isometric view of the action as you battle the forces of the World Economic Consortium. This one features gorgeous SVGA graphics, an incredibly dynamic environment, and even some role-playing elements.

Action fans will thrill to **Fade to Black** (\$59.95 list; Electronic Arts, 800-245-4525). This 3-D, polygon-based game uses interesting camera angles as it pits you against a race of shape-shifters. Best of all, there's plenty of atmosphere and more story than the typical action game.

Like *Fade to Black*, **Magic Carpet II** (\$59.95 list; Electronic Arts, 800-245-4525) injects a story and plot into a dazzling 3-D action setting. With more spells than the original, beautiful terrain, and an improved 3-D engine, your ride on the magic carpet is sure to be an adrenaline-filled experience.

For action that's down to earth (literally), **MechWarrior 2** (\$59.95 list; Activision, 310-473-9200) offers the ultimate in ground-pounding action.

You pilot walking robotic warriors in a series of combat missions. *MechWarrior 2* has fabulous sound and music, SVGA graphics, lots of weapons, and good multiplayer support.

Silent Steel (\$45 street; Tsunami, 209-683-8288) is an adventure set in our own century. In this exciting, nerve-racking interactive movie

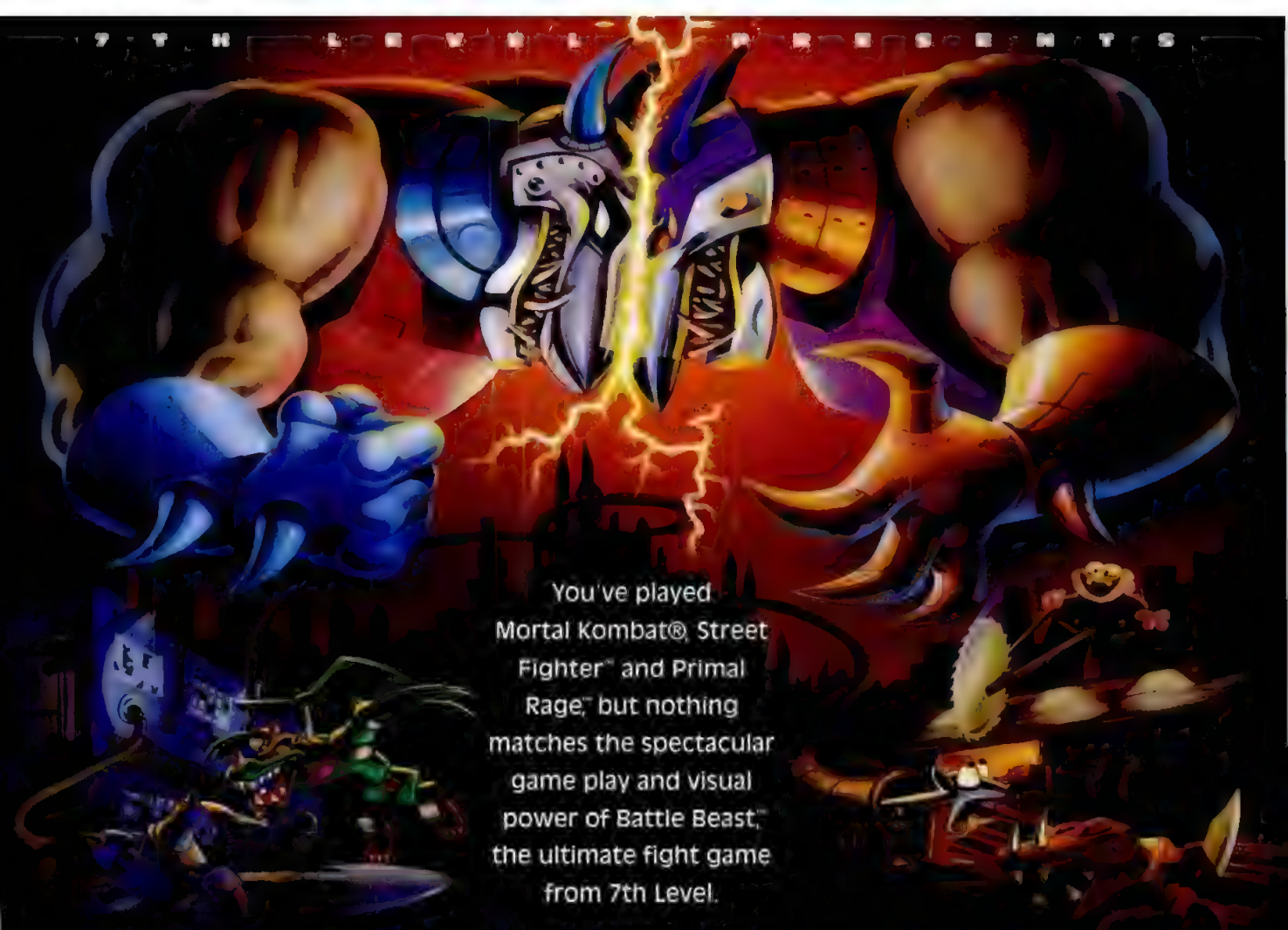


FADE TO BLACK

(available in Indeo and MPEG versions), you play the captain of a nuclear submarine. Not only are rogue Russian attack submarines in your patrol area, but there's a traitor on board who will reveal your location if you don't find him first.

For adventure on the lighter side, **Space Quest VI: The Spinal Frontier** (\$44.95 list; Sierra On-Line, 800-757-7707) provides the perfect escape. This graphic adventure features the further escapades of the universe's most famous janitor, Roger Wilco, who doesn't get a lot of respect but does get a lot of laughs. You can even play this one under Windows 3.x or Windows 95.

You'll also get a few laughs out of **Full Throttle** (\$45 street; LucasArts Entertainment Co., 800-985-8227) but you'll get them with a lot of attitude. In this cartoonlike graphic adventure you play Ben, the tough leader of a motorcycle gang in a postapocalyptic America. Ben has been framed for murder and must clear his name



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WINDOWS™ 95

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CIRCLE 146 ON READER SERVICE CARD



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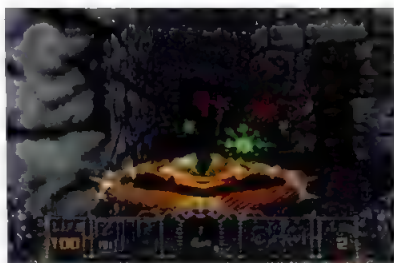
**Products
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while saving the world's last motorcycle company.

Sierra On-Line's latest adventure is much more serious in nature. In **Phantasmagoria** (\$69.95 list; Sierra On-Line, 800-757-7707), you play a young woman who moves into an old house and accidentally unleashes an unspeakable evil that takes over her husband. Lots of full-motion video (on seven CD-ROMs!), creepysets, and eerie music set the stage for this horror story. With graphic violence and suggestive sexual content, *Phantasmagoria* is not meant for kids: Consider it rated NC-17.

If you haven't yet had your fill of sensational murder trials, then in **the 1st Degree** (\$50

street; Broderbund, 800-521-6263) will keep you mesmerized. You're the prosecutor, looking to convict an artist of first-degree murder. The motives are clear, but there are discrepancies in testimony and lying witnesses that show you just how tough it is to prove a criminal case beyond a reasonable doubt.



HEXEN: BEYOND HERETIC

Buried in Time: The Journeyman Project 2 (\$64.95 list; Sanctuary Woods, 800-943-3664) continues the adventure be-

gun in the original *Journeyman Project* and adds a QuickTime 3-D engine that lets you travel around the painstakingly rendered surroundings. In this Windows (3.x or 95) adventure, you have to travel through time to clear your name after your future self informs you that you've been framed for altering history.

Another Windows game, **Dust: A Tale of the Wild West** (\$49.95 list; Cyberflix, 615-546-1157) features a refreshing mix of adventure and first-person action. You're the new arrival in a frontier town, and you have to face The Kid in a few days. To get through the game, you have to master arcade-action gun-fights as well as *Myst*-like puzzles.



MECHWARRIOR 2

Like *Dust*, **Burn: Cycle** (\$49.98 list; Phillips Media Group, 800-340-7888) mixes a number of arcade sequences with some abstract puzzles, all in a cyberpunk setting that looks like the film *Blade Runner*. You play a hacker who's been victimized by a computer virus designed to work on human brains. Now you have to find the cyberpunk equivalent of Norton AntiVirus.

—Bernard Yee

NEW VERSIONS OF OLD FAVORITES

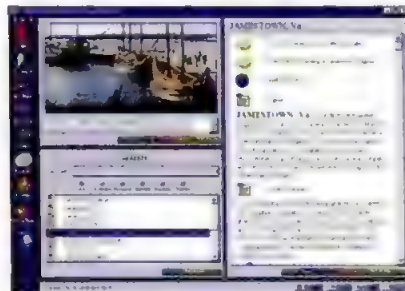
Some titles seem to be popular no matter what the season. Here's a look at new versions of some of the most popular CD-ROMs year in and year out.

Compton's Interactive Encyclopedia (\$80 street; Compton's New Media, 800-261-6109) has been redesigned and expanded for 1996. Compton's weighs in with 35,000 articles, 8,000 pictures, 100 videos and animations, and 15 hours of sound. Perhaps of more interest to parents are the all-new learning centers, newsroom, playroom, and spaceship that captivate young minds and encourage browsing. Either of two search options will help you answer specific questions.

Meanwhile, **Encarta '96** (\$59.95 list; Microsoft Corp., 800-426-9400) has expanded and updated content along with a new look and feel. An optional on-line Yearbook Builder provides about 40 updates each month to keep the 26,000 articles fresh and current. Eight thousand pictures, 100 minutes of video, and 950 maps supplement the text. New for 1996 is

the ability to highlight and print just a section of an article.

Everyone's favorite movie guide just got better. **Cinemania '96** (\$59.95 list; Microsoft Corp., 800-426-9400) adds 1995's hot



COMPTON'S INTERACTIVE ENCYCLOPEDIA

movies to its already comprehensive database of 20,000 reviews and 4,000 star profiles. *Cinemania* still only covers movies available on video, but a new link with The Microsoft Network lets you download new reviews and updated biographies each month.

When you start watching reference

books and old movies, you know it's time to get out of the house. Plan a road trip using the updated **TripMaker '96** (\$39.95 list; Rand McNally, 800-671-5006). This is a great way to plot a route if you know the cities you want to visit, and the new *Explorer Guide* can help you plan a trip even when you don't have a destination in mind. *Explorer* suggests the "in" spots and some not-so-obvious choices you might have overlooked. Of course, *TripMaker* still computes mileage, travel time, and the fastest or most scenic route.

If you'd rather send a card than go on a road trip, simply fire up **PrintMaster Gold CD Publishing Suite** (\$50 street; MicroLogic, 800-888-9078). The software has been updated and redesigned to make it easier to create and print greeting cards, banners, signs, labels, envelopes, calendars, fax sheets, and business cards. New this year: an address book and an audio tutor to guide you through projects step by step.

—Donald B. Trivette

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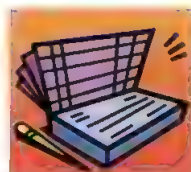
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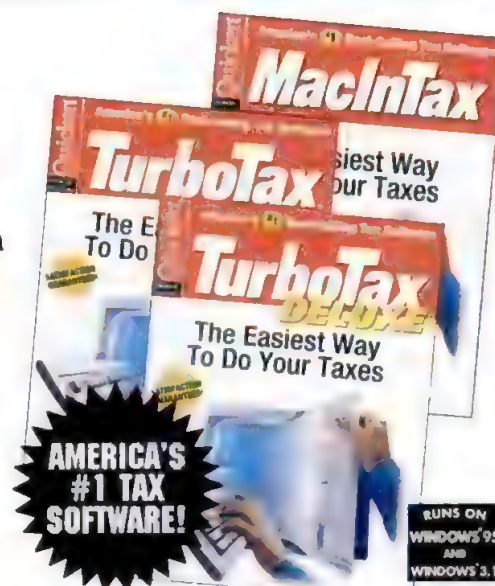
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GAMES/STRATEGY AND SIMULATION

Fly, Drive, Fight, and Scheme Like Crazy

WITH A MIX OF STRATEGY, role-playing, and plain old adventure, **Jagged Alliance** (\$60 street; Sir-Tech Software, 315-393-1525) is sure to challenge just about every gaming skill you've got. You command a team of mercenaries struggling to recapture a remote island from the clutches of a renegade scientist. Great graphics, sound, and voice tracks enhance this captivating title. By the time you read this, a multiplayer add-on, **Jagged Alliance: Head to Head**, should be available.

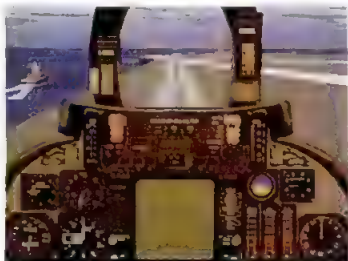
For combat action with a greater emphasis on quick thinking, try **Command & Conquer** (\$60 street; Virgin Interactive Entertainment, 714-833-8710). In this nerve-racking, thoroughly addictive game, you command forces from either the Brotherhood of Nod or the Global Defense Initiative in a struggle for total global dominance. But every move you make occurs in real time, so if you waste time plotting your next strategy, you're history. You can play this one over a modem or LAN link, and it runs very well under Windows 95.

Not all strategy games are violent, as **SimIsle, Missions in the Rainforest** (\$39.95 list; Max-is, 800-526-2947) proves. In this latest Sim title, you have to manage a series of islands and keep them prosperous while at the same time protecting the environment. Cool music and beautiful SVGA

graphics help set the mood.

Another peaceful strategy game, **Transport Tycoon Deluxe** (\$50 street; MicroProse, 800-879-7529) puts you in charge of a fledgling transportation company. You have to build roads, railroads, shipping docks, and airports to win subsidies before your competitors. Otherwise, your company may not stay afloat in this SimCity-style management game.

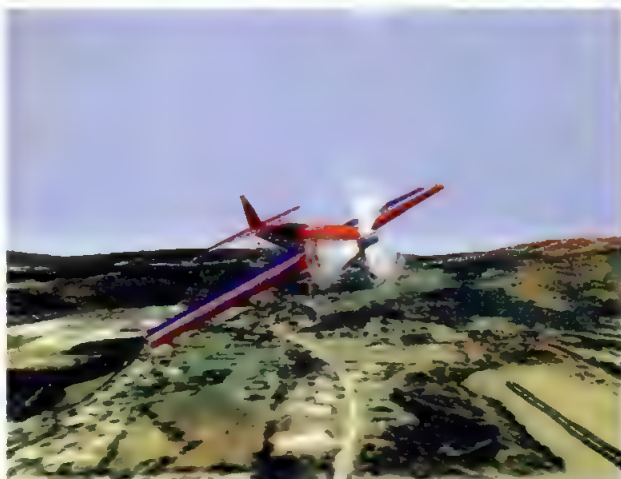
Once the roads are built, someone has to race around them. In **NASCAR Racing** (\$59.95 list; Papyrus Design Group, 800-836-0033), you



TOP GUN: FIRE AT WILL

get an up-close-and-personal view of the road as you whip around nine different tracks at a thrilling 180 miles an hour. Stunning SVGA graphics and great multiplayer options set this apart from other driving simulations.

Leave the roads and the earth behind in **Flight Unlimited** (\$79.95 list; Looking Glass Technologies, 617-441-6333). This excellent flight simulation package lets you cut loose in the skies in a variety of aerobatic aircraft. No guns, no missiles, just lots of high-flying (and downright therapeutic) fun. The amazing pho-



FLIGHT UNLIMITED

to-realistic graphics and heart-stopping realism will send you soaring.

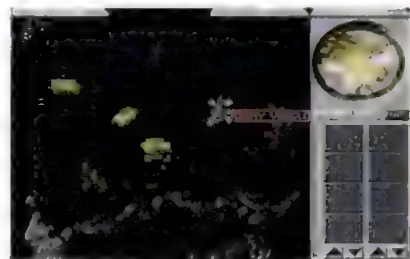
Another graphically stunning flight simulator, **U.S. Navy Fighters Gold** (\$59.95 list; Electronic Arts, 800-245-4525) includes the latest version of the original U.S. Navy Fighters plus the Marine Fighters expansion pack, for a total of 85 missions. Several new aircraft include three variants of the Harrier (which takes off and lands vertically), as well as the monstrous AC-130 Spectre gunship.

Flying and fighting also take center stage in **Top Gun: Fire at Will** (\$50 street; Spectrum Holobyte, 800-695-4263). Based on the movie of the same name, **Top Gun** mixes great graphics with a heavy emphasis on fun and ease of use. Full-motion video sequences give the game the convincing feel of an interactive movie.

For a completely different kind of flying, fire up **Apache** (\$69.95 list; Interactive Magic, 919-461-0722). This attack

helicopter simulation utilizes crisp, polygon-based SVGA graphics and should appeal to cyberfliers of all skill levels. It may take a while to get the hang of chopper flying, but it's worth it. The game also supports modem and network multiplayer modes.

The only seafaring game in this group is also the only Windows 95-specific title. **Command: Aces of the Deep** (\$50 street; Sierra On-Line, 800-757-7707) is an enhanced version of the original Aces game that includes many extra missions and phenomenal SVGA graphics. You com-



COMMAND & CONQUER

mand a German U-boat in World War II and can embark either on single missions—they can be historic or imaginary—or full-blown campaigns at sea.

—Michael E. Ryan

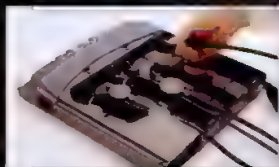
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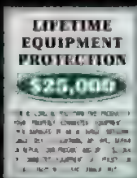


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GAMES/SPORTS

Fun for Armchair Athletes

IF YOU JUST CAN'T GET enough of the great American pastime, you definitely won't be able to get enough of **Hardball 5** (\$59.95 list; Accolade, 408-985-1700). The latest entry in the Hardball series offers great SVGA player animations and better, more detailed views of the action.

For even more baseball action—and all the statistics you can handle—check out **Tony LaRussa Baseball 3** (\$59.95 list; Electronic Arts, 800-245-4525). This amazing title offers arcade and strategy play modes, as well as a fantasy draft and realistic stats that any baseball nut will love.

For the ultimate in sports simulations, hit the ice with **NHL 96** (\$64.95 list; Electronic Arts, 800-245-4525). The SVGA graphics and multiple camera angles will leave you speechless, and the fast-paced, hard-hitting action may just send you face first into the boards. Everything you love about hockey is in this game (yes, even the fighting).

Another Electronic Arts title, **PGA Tour 96** (\$64.95 list; Electronic Arts, 800-245-4525) is a richly detailed golf simulation that will make you feel like you're really on the course. Great graphics, sound effects, and action make this one a must-have for the dri-



NHL HOCKEY 96

ving-range junkies on your list.

Even if you stink at the real game, **Virtual Pool** (\$39.95 list; Interplay Productions, 800-969-4263) will hook you. Featuring a terrific graphics engine, this game is so much

like the real thing that you'll forget you're not in a smoke-filled pool hall. This title runs well under Windows (3.x and 95) and includes some helpful video clips.

—Michael E. Ryan

10 GREAT GIFTS FOR UNDER \$35

If you're trying not to break the bank this holiday season, here's a selection of potential gifts and stocking stuffers that can be had for under \$35.

Interactive adventures weren't always as visually enticing as *Myst*. Longtime gamers will appreciate *The Sci-Fi Collection* (\$19.99 list; Activision, 310-473-9200), a CD-ROM anthology of seven classic, text-based adventure games, including *The Hitchhiker's Guide to the Galaxy*, *Starcross*, and *Beyond Zork*.

For a collection of some more contemporary favorites, check out *The LucasArts Archives, Volume I* (\$25 street; LucasArts Entertainment Co., 800-985-8227). This amazing five-game bundle includes such classics as *Sam & Max Hit the Road*, *Day of the Tentacle*, and a special edition of *Rebel Assault*, along with demos of upcoming LucasArts titles.

Gary Trudeau's *Doonesbury* cartoon is known for lampooning popular culture, not to mention its political satire. Now you can add those views to your desktop with *Doonesbury Screen Saver* (\$22 street; Mindscape, 800-234-3088), which provides ten

original, animated *Doonesbury* modules.

For the little ones, there's *The Escape of Marvin the Ape* (\$19.95 list; T/Maker, 415-962-0195), a VroomBooks interactive book based on the Penguin Books children's title of the same name. This is actually a multilingual title, which makes it easy for you to introduce your child to French, German, and Spanish.



THE LUCASARTS ARCHIVES, VOL. I

You can aid the budding gardeners on your list with *Flower Gardening for Windows* and *Vegetable Gardening for Windows* (\$14.95 list, each; Expert Software, 800-759-2562). Each of these products helps novices and seasoned gardeners alike plan, design, and maintain a blooming garden.

Comics and graphic novels are growing more popular every day, and *Reflux* (\$19.99 list; Inverse Ink, 800-771-1344) takes them one step further. This is the first in a series of live-action, martial arts graphic novels for the PC.

Creating personalized business cards, letterheads, and certificates has never been simpler thanks to the aptly titled *World's Easiest Personal Image Bundle* (\$30 street; T/Maker, 800-730-3279), which features simple step-by-step prompts, predesigned templates, a selection of clip art, and compatibility with PaperDirect's paper stock.

The '95-'96 NFL Interactive Yearbook (\$34.95 list; Virgin Interactive Entertainment, 800-554-4420) is a must-have for football fans, as it offers detailed information on each NFL team. You can even download the current season's data using a free on-line update service.

If the psychedelic Seventies are more your thing, you need *The Groove Thing* (\$30 street; Big Top Productions, 800-900-7529), a marvelously fun digital kaleidoscope with chaotic colors and visually captivating designs.

—Melissa J. Perenson

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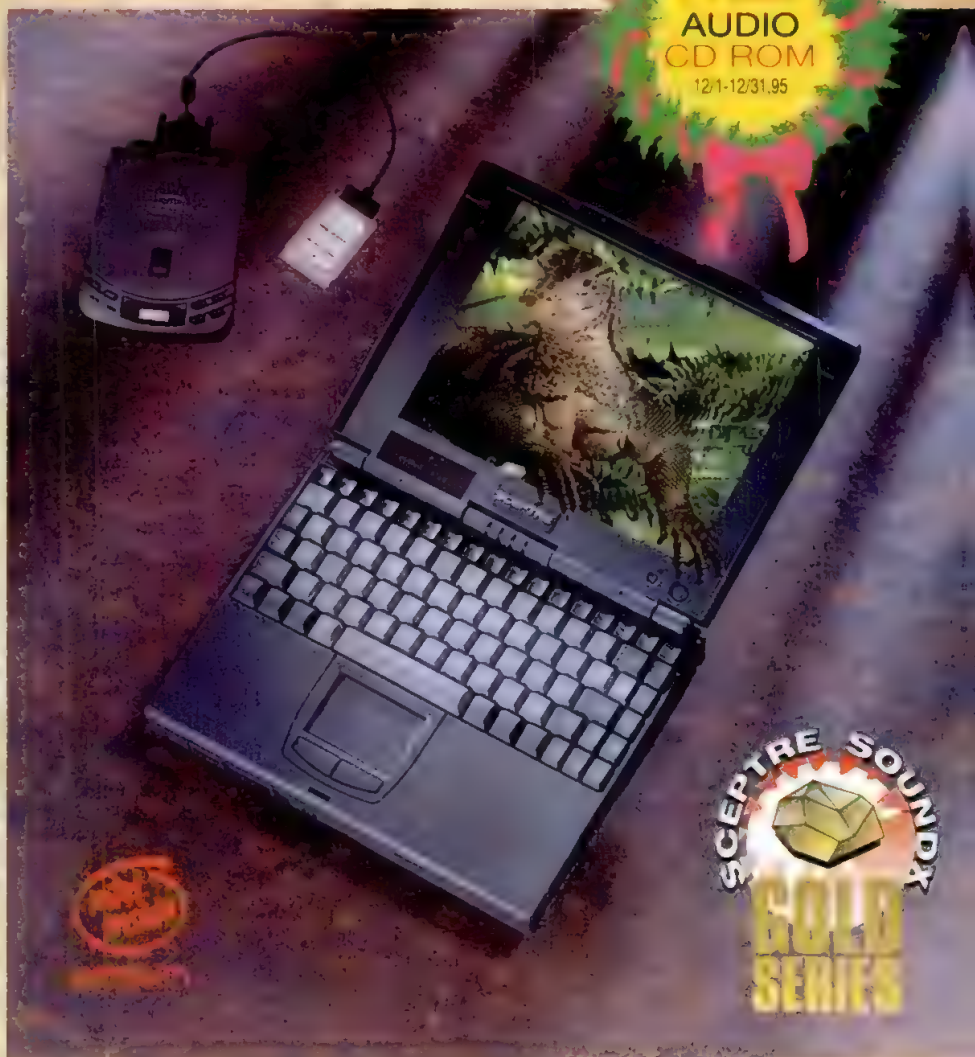
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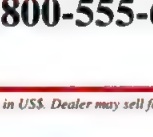
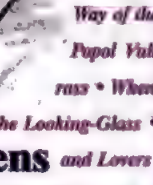
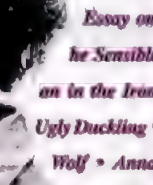
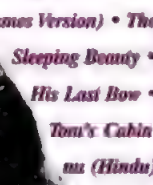
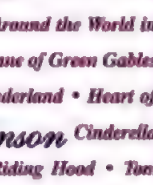
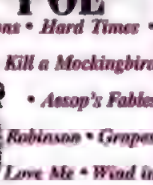
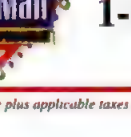
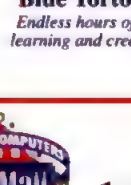
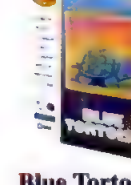
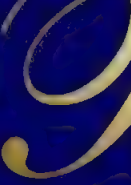
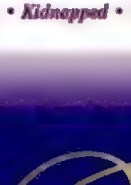
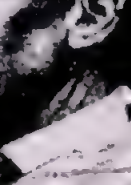
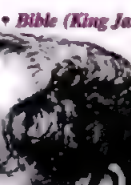
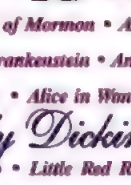
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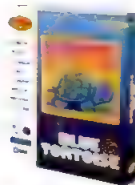
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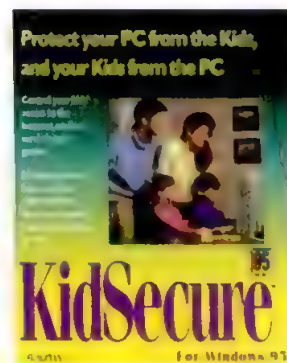
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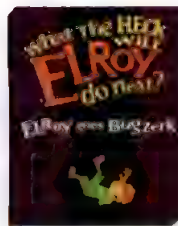
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GAMES/ARCADE GAMES AND PUZZLES

Thumb-Numbing, Brain-Twisting Fun

IF YOU LONG FOR THE Atari 2600 glory days of gaming and Activision favorites like *Pitfall*, then **Pitfall: The Mayan Adventure** (\$49.95 list; Activision, 800-477-3650) is definitely for you. In this Windows 95-specific title, you guide Pitfall Harry Jr. as he runs, swings, and bungees his way through the treacherous, creature-infested jungle in an effort to rescue his father from an evil Mayan spirit. Watch out for those crocodiles.

Fans of Tetris will love **Quirks** (\$26.95 list; Spectrum Holobyte, 800-695-4263). It's

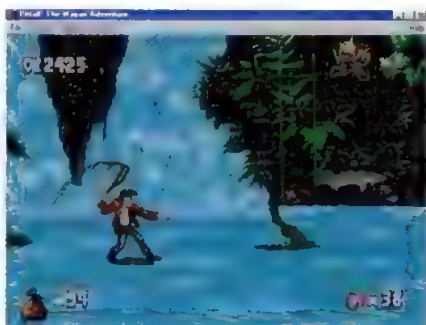
your job to take the falling pairs of Quirks (blobs with eyes) and maneuver them into groups of four or more that can be zapped into the eighth dimension. Battle against yourself or against computerized opponents, or go head to head with your friends.

Combine Tetris with Space Invaders and you'll get something like **Pressure Drop** (\$29.95 list; StarHill Productions, 800-304-4263). Here you use your chromogun to blast relentlessly falling rows of colored blocks by making all the blocks the same color. With mesmerizing backgrounds, addictive play, and 99 progressively faster and more difficult levels, this is sure to bring endless hours of fun.

Nothing is more arcadey than pinball, and **Full Tilt!** (\$29.95 list; Maxis, 800-526-

2947) is one of the best computer pinball games around. This Windows 95-specific simulation features superior 3-D graphics, quality play, and authentic ball physics, as well as the ability to tilt and nudge the table.

Another Windows 95 title, **Shanghai: Great Moments** (\$29.95 list; Activision, 800-



PITFALL: THE MAYAN ADVENTURE

477-3650) renews the ancient game of mah-jongg. The tiles have themes, such as great moments of romance or science fiction. Match certain tiles, and you'll be treated to a video clip from some classic movies.

For more lively arcade action, try your hand at **Primal**



SHANGHAI: GREAT MOMENTS

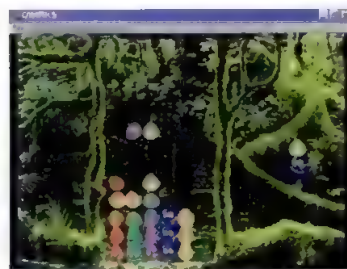
Rage (\$49.95 list; Time Warner Interactive, 408-433-3999). This arcade fighting game uses realistic 3-D graphics and features some intense hand-to-hand combat between newly resurrected dinosaurs and monster primates.

Providing just as much fun, but without the violence, **Zoop** (\$39.95 list; Viacom New Media, 800-469-2539) is one of those games you'll keep loaded all day long. Contained on just a single floppy disk, Zoop challenges you to ward off an ever-advancing parade of multicolored blobs by zapping the ones that match the color of your triangle.

To get away from stress completely, try the incessantly upbeat **Endorfun** (\$29.95 list; Time Warner Interactive, 800-482-3766). This psychedelic puzzler has you rolling a cube around a free-floating grid, trying to touch colored spots with the appropriately colored side of your cube. The game's surreal feel has something to do with its 500 levels and 100 "subliminal affirmations" ("I am a wonder-



DIABOLICAL DIGITS



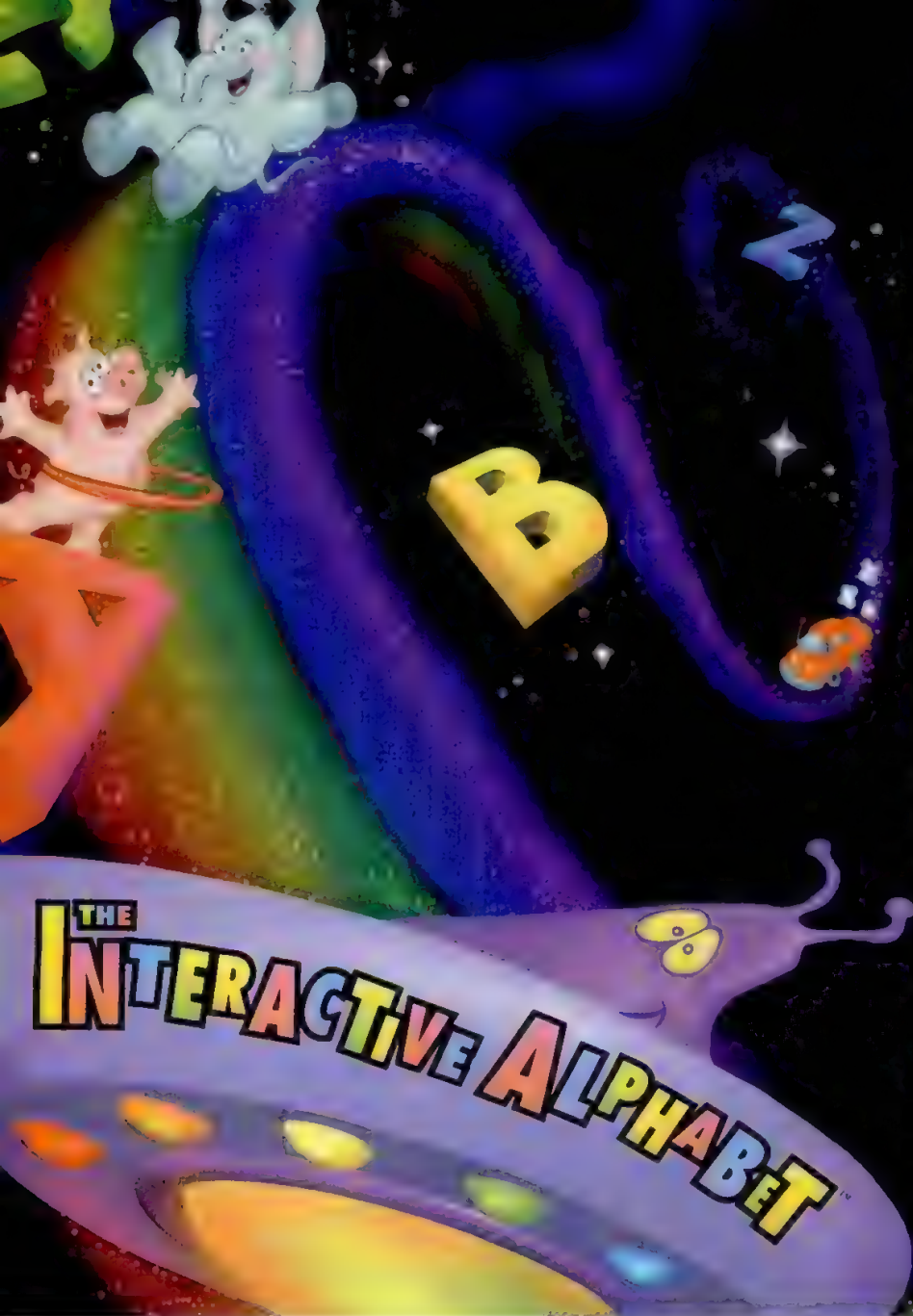
QUIRKS

ful person," for instance).

If you prefer your cerebral stimulation in the form of trivia, you'll definitely like **You Don't Know Jack** (\$30 list; Berkeley Systems, 510-549-2300), sort of a "Jeopardy" for real people. Instead of being grilled on obscure topics, you'll choose from such brain-bending topics as "The Sociological Implications of Scooby Doo." With more than 800 questions culled largely from pop culture, the game is organized into 40 challenges of 30 minutes each, giving you more than 20 hours of brain-numbing bliss.

But if you *really* want to feel that cranial burn, **Diabolical Digits** (\$29.95 list; Millennium Media Group, 800-892-6848) is the game for you. It includes countless challenging numeric puzzles, each of which takes place on a 3-D geometric grid. As if that's not enough, there are also hundreds of rule variations, so no two games are ever alike.

—Shane Mooney



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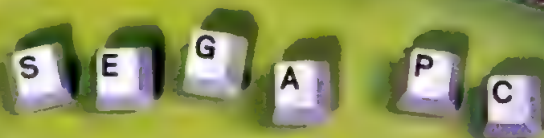


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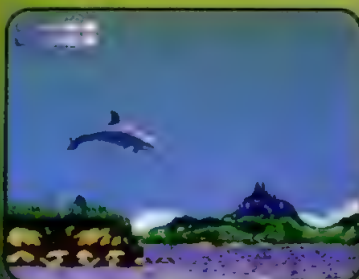


When you think ECCO THE DOLPHIN, COMIX ZONE, TOMCAT ALLEY or other, you don't say "Because Sega has enhanced these hit games specifically for today's faster PC processors."

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COMIX ZONE now features lightning-quick arcade-style action, instant installation for instant fighting, as well as great graphics drawn by real comic book artists!



ECCO THE DOLPHIN now offers higher resolution graphics, expanded difficulty levels, added video segments and multiple control modes.



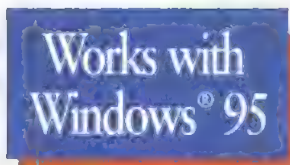
TOMCAT ALLEY has a higher video frame rate (20 frames per second), over an hour of near-VHS quality video, plus full-screen video. And, it's joystick-controllable!

"Yeah, we know "funner" isn't really a word. And "Ecco" and "Comix" aren't spelled that way. But who asked you anyway?"

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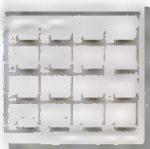
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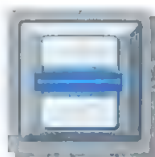
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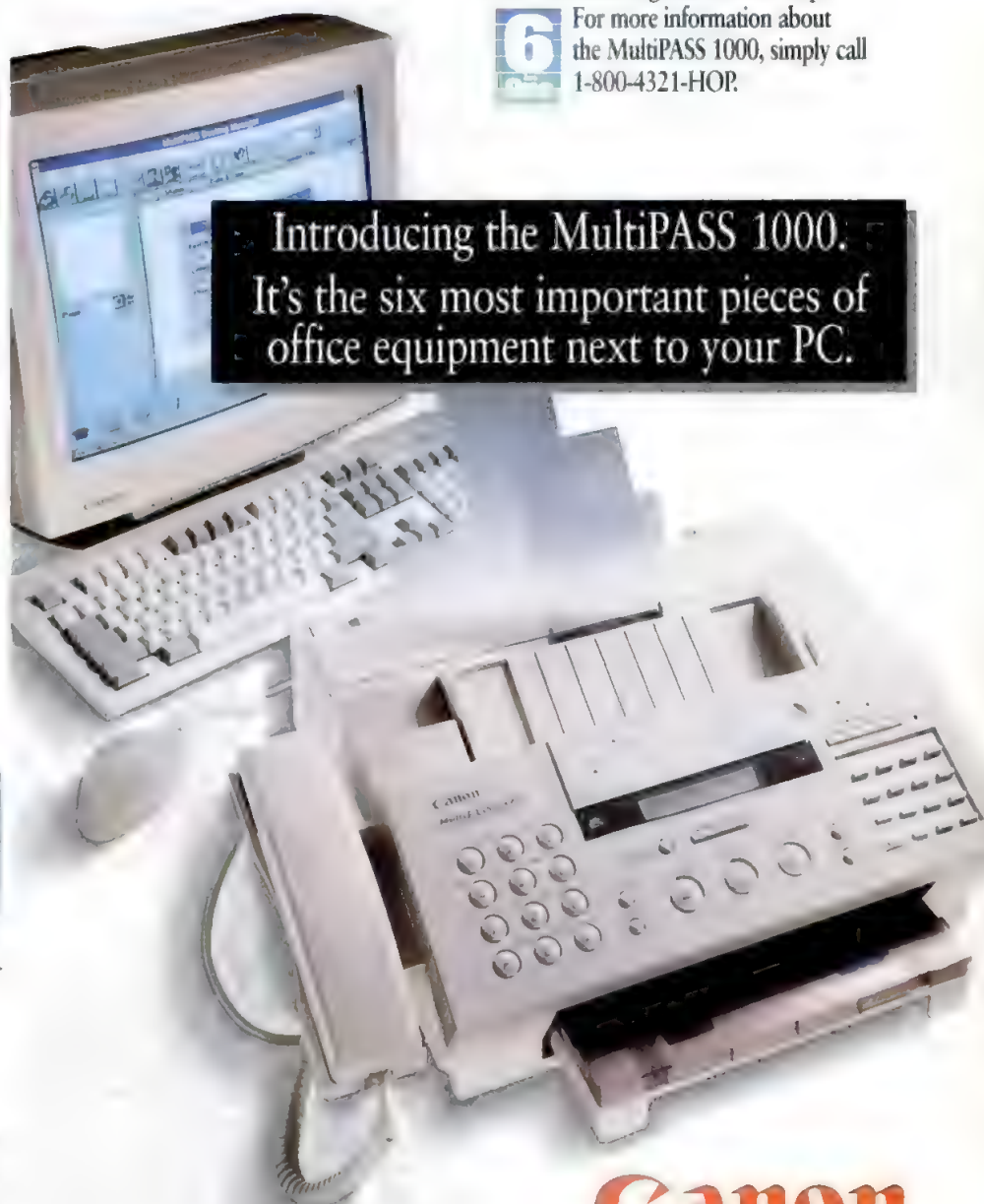


receive faxes while you're printing or when your PC is off. You can view faxes with zoom and full rotation, then save, print, forward or delete them. You can create a custom cover sheet and a virtually unlimited fax address book.

It's a Scanner. The MultiPASS 1000 offers TWAIN-compliant scanning with 200 x 200 dpi resolution and seven-level contrast control. It is compatible with most OCR software, enabling you to edit imported text without keying it in. And the 30-sheet auto document feeder lets you easily scan multi-page documents.



Introducing the MultiPASS 1000.
It's the six most important pieces of office equipment next to your PC.



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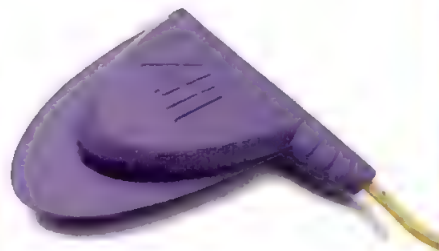
The one with the most toys wins, right? Here are six of the coolest computer toys out there, each of which is just as fun as it is functional.



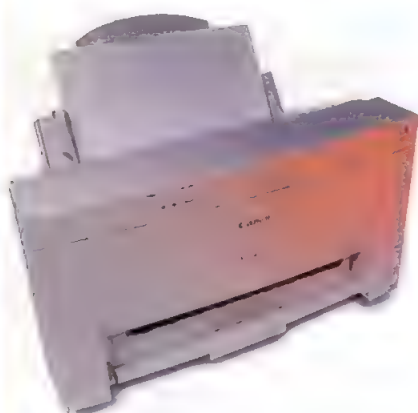
If you haven't played Heretic through the **Virtual i-O i-glasses**, then you haven't really played Heretic. This 8-ounce virtual reality headset gives you hi-fi sound and full head tracking to guarantee an immersive experience. The gadget is supported by Windows 95 and OS/2, and lots of game developers (\$799 list; Virtual i-O, 206-382-7410).



With **EasyPhoto**, you no longer have an excuse for leaving photos to rot in a shoebox. This software/scanner combo makes it easy to digitize photos and drag them into any document. Just plug it into your printer port and feed in some snapshots (\$269 list; Storm Software, 800-275-5734).



Air guitarists, stand up and take notice. **Vpick** (Virtual Pick) is an oversize guitar pick that lets you strum along with your favorite Aerosmith tunes in an adventure game that takes you from garage band to the big time. Just plug Vpick into a free COM port, load up the included CD, and start wailing on any available surface (\$14.95 list; IBM Multimedia, 800-898-8842).



So you thought all your printer was good for was creating clean-looking reports and presentations. The **Canon BJC-4100** is going to change all that. This four-color Bubble Jet printer comes bundled with Canon Creative, a CD-ROM full of high-powered creativity software. You can even use this printer to create your own T-shirt transfers, cotton pillows, and other craft projects (\$359 street; Canon Computer Systems, Inc., 800-423-2366).



If you're serious about flying or alien hunting, you have to check out the **SideWinder 3D Pro**. This solid, eight-button joystick (with throttle and a hat switch) gives you true digital performance under Windows 95 and regular analog performance under DOS (\$59.95 list; Microsoft Corp., 206-882-8080).



Modems just don't look any funkier than the **Quicktel 28,800 V.34 External Fax/Modem**. This wedge-shaped wonder combines sleek lines with amusing and informative LEDs to create a modem that's perfect for either getting on-line or into the pages of a design magazine (\$279 list; LogiCode Technology, Inc., 800-735-6442).



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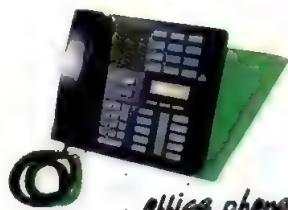
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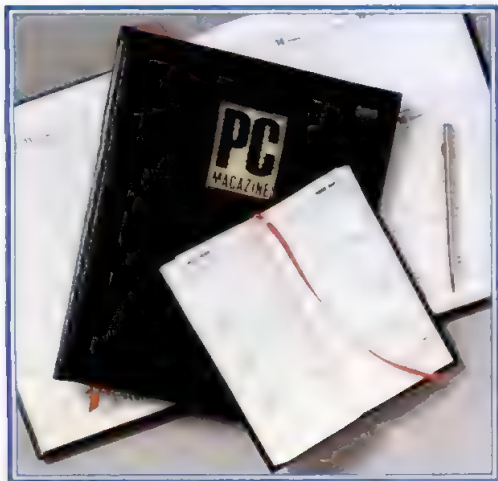


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With full-color photographs, animation, and audio and video clips, reference works on CD-ROM are not only user-friendly but lots of fun. We culled through a pile of products to bring you the best reference works on a wide range of subjects, all of which run well under Windows 95.

WHAT BETTER PLACE TO BEGIN a review of reference titles than **Our Times: The Multimedia Encyclopedia of the 20th Century** (\$69.95 list; Vicarious, 800-465-6543). This in-depth look at the people and events of our century contains 52,000 articles, 2,500 images, and 2 hours of narration by James Earl Jones. An overview with special articles and commen-

tary highlights each decade.

Apollo Interactive, The Complete Insider's Guide (\$15 street; WizardWorks Group, 612-559-5140) covers all the Apollo space voyages from 1967 to 1975. Beautiful drawings, animations, and historical video clips present each Apollo mission in minute detail.

For more on Apollo 13 (the movie, that is), try **The**

Corel All-Movie Guide (\$69.95 list; Corel Corp., 800-772-6735). This CD-ROM covers 90,000 movies and videos. You can search for movies by title, genre, or plot. This one has approximately 800,000 entries.

As a companion to the television series of the same name, **500 Nations** (\$35 street; Microsoft Corp., 800-426-9400) offers an in-depth look at 1,000 years of Native American history, narrated by Kevin Costner. The producers have collected 2,000 photographs, animations, and drawings to create a dynamic resource.

Providing a beautifully detailed look at a different culture, **Passage to Vietnam** (\$39.95 list; Against All Odds, 415-331-6300) is a breathtaking title. Shot by 70 award-winning photo-journalists, this collection includes 400 photographs and an hour of video.

For a closer look at the wildlife in Southeast Asia and other parts of the world, try **How Animals Move** (\$49.95 list; Discovery Channel Multimedia, 800-762-2189). Eleven guided tours and a dozen games explain in detail the mechanics of flying, swimming, burrowing, crawling, and slithering.

You get a close-up look at life beneath the waves in **Cities Under the Sea: Coral Reefs** (\$35 street; Interactive, 800-452-9999). The user pilots a submarine from one undersea laboratory to another and is treated to experiments, demonstrations, and lectures focusing on a variety of related subjects.

Back on dry land, you can

tour the world's most famous art museum in **Le Louvre: The Palace & Its Paintings** (\$49.95 list; Imagine the World, 812-829-1007). The best way to enjoy the Louvre (there are several) is on a detailed, narrated tour that showcases 100 paintings from eight centuries of art history.

Covering smaller-scale art, **Encyclopedia of U.S.**



HOW ANIMALS MOVE



APOLLO INTERACTIVE

Postage Stamps (\$29.95 list; Zane Publishing, 800-335-4059) is a comprehensive resource that lists all 2,573 face-different U.S. postage stamps issued since 1847. Each is presented with a detailed history and Minkus catalog number.

If your kids collect software instead of stamps, you need the **Parents' Guide to Software** (\$29.95 list; Newsweek, 800-634-3002, operator 7). Newsweek chose 50 "good" CD-ROMs in areas like creativity, reading, and reference. Each is rated for content, replay, multimedia, interactivity, and design.

—Donald B. Trivette



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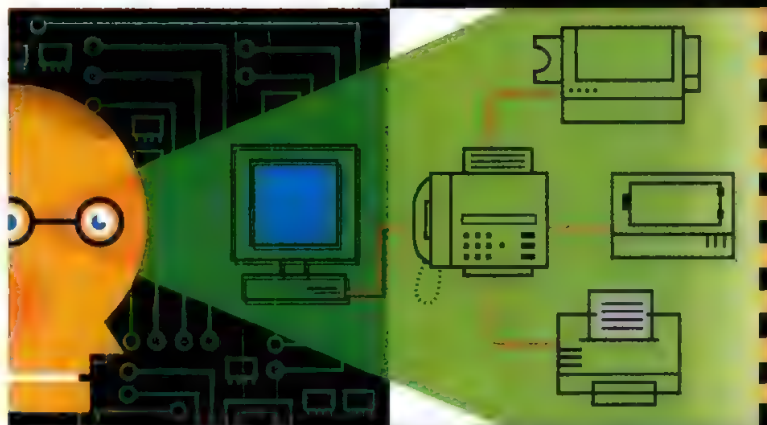
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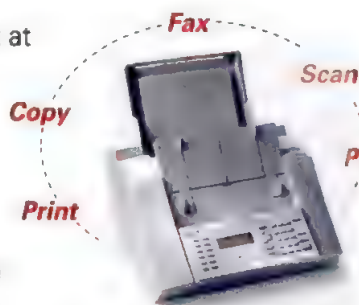
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This eclectic mix of software should help make your holiday shopping easier. From business cards to greeting cards, from cooking to personal finance, there's a product here that can help.

IF YOU WANT TO GET COOKING with your PC, or if you just like to eat, load up **Cooking With Dom DeLuise: Fast, Fun and Healthy** (\$49.95 list; Allegro NewMedia, 201-808-1992).



BETTER PHOTOGRAPHY

Dom DeLuise takes a light-hearted approach to all sorts of recipes and provides a multitude of tips, techniques, and jokes to make cooking fun and easy.

You no longer need a professional printer to get great-looking business cards. With **Easy Business Cards for Windows** (\$39 street; Claris Corp., 800-544-8554), all you need is your PC and a laser or ink jet printer. This useful package contains more than 290 business card styles, along with

custom design tools and sample card stock.

To try your hand at a different kind of card game, try **Hallmark Connections Card Studio** (\$49.99 list; Micrografx, 800-733-3729). This CD-ROM contains over 1,000 colorful greeting cards, as well as tools you can use to edit them or create your own.

If you have people on your list who just can't seem to get the hang of Windows, give them **Professor Multimedia with Windows for Dummies** (\$29.95 list; Individual Software Inc., 510-734-8337). This may be the consummate Windows 3.11 teaching tool. It offers a multi-part interactive tutorial that guides novice users through the intricacies of Windows.

Better Photography: Learning to See Creatively (\$79.95 list, CD-ROM and book, \$59.95 list, CD-ROM only; DiAmar Interactive Corp., 206-340-5975) includes everything you need to create more interesting photographs. It's a

tutorial that mixes photos, text, and audio clips to introduce you to a variety of photographic techniques.

And let's not forget video cameras. **Video Director Home** (\$49.95 list; Gold Disk, 408-982-0200) is an easy-to-use title designed to help you create a complete movie from your raw video footage. It installs simply and requires little setup; just select your VCR and video camera and you're ready to go.

Music Mentor 2.0 (\$99 list; Midisoft Corp., 206-391-3610) is an excellent teaching tool for music fans of all tastes and skill levels. This package includes Music Mentor, which teaches basic concepts and terms, and Mentor Personal Studio, which lets you edit and mix your own MIDI music.

If you need a way to organize your photos, videos, and sound clips, give **Echo Lake** (\$59.95 list, CD-ROM, \$49.95 list, floppy; Delrina Consumer Software, 408-363-2345) a look. This fantastic package lets you combine everything from video to text in a customized book of

memories that can be saved, printed, or "packaged" on a disk and sent to friends and relatives.

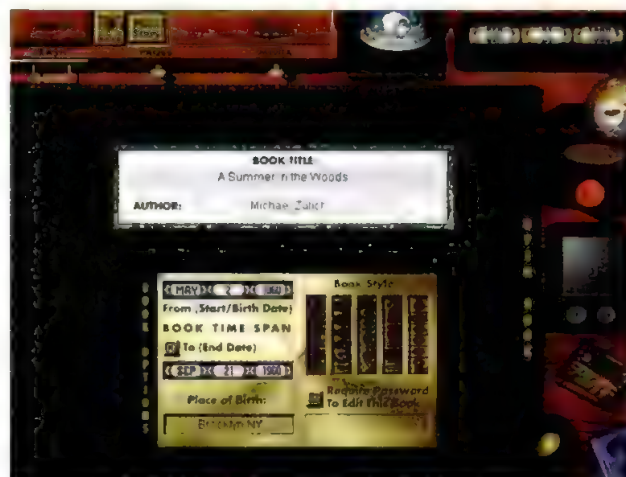
To help you better control your finances, **Microsoft Money for Windows 95** (\$34.95 list; Mi-



VIDEO DIRECTOR HOME

crosoft Corp., 206-882-8080) provides on-line banking (through 15 national banks), a consolidated bank account, electronic payments, payment reminders, and investment portfolio tracking—all a simple mouse click away.

If you have kids surfing the Net, **Net Nanny** (\$49.95 list; Net Nanny Ltd., 604-662-8522) can help you watch where they go. This extra set of eyes makes use of an owner-defined dictionary of words, terms, or numbers to prevent users from accessing specific spots on the Internet.—Michael J. Zulich □



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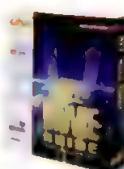
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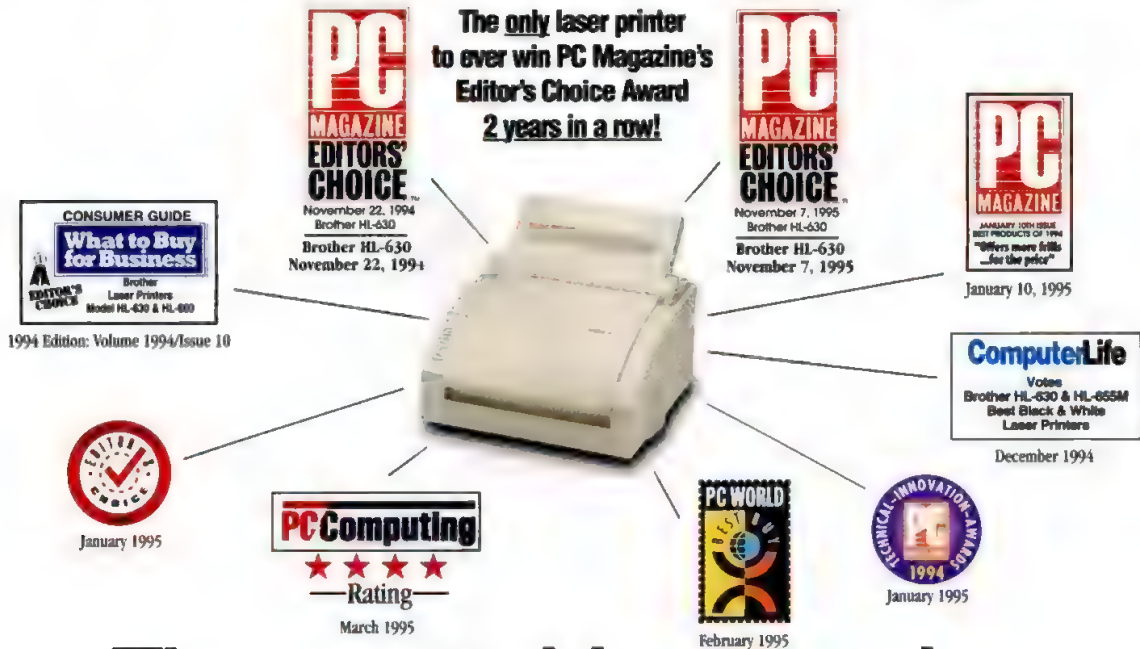
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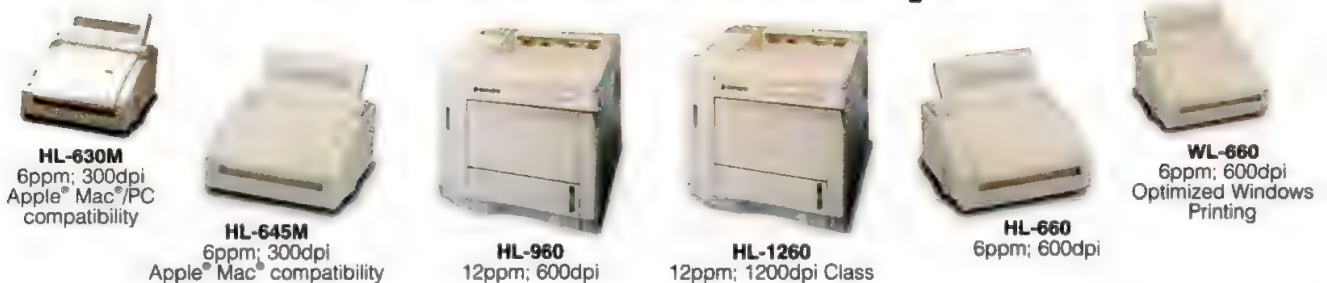
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Coming Up

The Best Products of 1995

We continue our tradition of looking at the best products from the preceding year—the software, hardware, the services, the *tools*—that left memorable marks in our minds. As new *types* of products emerged, we cast a wider net to include up-and-comers that now comprise the best of fun, of on-line services, and of Internet tools—to name a few. And we also take a fond look at some of the best bleeps, bloopers, and blunders in “Jim Seymour’s Thumbs Up, Thumbs Down” and “The Best of Abort, Retry, Fail?”

Sound, Speakers, CD-ROM Drives

Multimedia hardware is entering its second generation. The sound card, speakers, and CD-ROM drive that came with your system were good enough, but now you want more—sound cards with more realistic samples, speakers with a richer sound, a CD drive with more speed. For our next issue, our reviewers plugged in and turned up the volume on a profusion of peripherals for the mediaphile in all of us: We tell you about the coming wave of “multifunction” sound cards and DSPs. We also review 28 pairs of upgrade speakers to enhance your multimedia PC and test 6 sextuple-speed CD-ROM drives to see whether the extra speed is really there.

Networked CD-ROMs

CD-ROM has rapidly become the most popular medium for distributing large amounts of data—everything from giant reference materials like Computer Select and Medline to entire operating systems. It's time to provide your network with access to these resources, but what is the best way to share CD-ROMs on your LAN? Can you use NetWare's CD-ROM-sharing capabilities, or do you need separate software? Or should you go for a tower configuration that comes complete with its own CPU, hard disk, CD-ROM drives, and software? PC Labs tests 21 CD-sharing solutions from 11 vendors—everything from software packages that let you use your own hardware to combination hardware/software systems that you just plug in and turn on.

Hot New RAD Tools

Client/server programmers just got two intriguing new visual development tools: Microsoft Visual Basic 4.0 and Oracle Power Objects. We offer a look each product's approach to SQL database connectivity, object orientation, code reuse, OLE automation, and custom controls. Each product offers a unique slant on client/server database development, but both are serious contenders for programmers using BASIC.

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NE—Network Edition

To obtain the Network Edition of *PC Magazine* call Circulation at 800-289-0429.

Abort, Retry, Fail?

THE LIGHTER SIDE OF PERSONAL COMPUTING

By Don Willmott

Military Intelligence

"There is a power outage of the uninterruptible power supply system scheduled from 2000 hours on 11 August 1995 until 0800 13 August 1995."—DEFENSE INFORMATION SYSTEM AGENCY E-MAIL

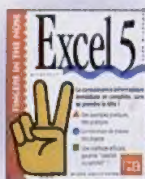
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(Bangor Daily News.)

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Mon Dieu!
Calling all French speakers... What the heck is this book supposed to be about? (PC Expert.)



Richard Tennant

Press Releases We Never Finished Reading

"Over nine million people were laid off during the last four years, many from companies almost as stable as *PC Magazine*."—ONTRACK MEDIA CORP. PRESS RELEASE



Perfect. A CD-ROM that tells you how to start a business without a computer.

Spreadsheets with Attitude

Faithful reader Miriam Otte, who uses speech-synthesis tools to teach Lotus 1-2-3 to blind students, was surprised when a student said her computer had just called her a "total ass." Upon looking at the screen, Miriam found that the column for "Total Assets" had been narrowed a bit too much, and the synthesizer read only what was visible in the cell.

New Ways for Feuding Lawyers to Insult Each Other

One of the surprises that emerged in the wake of the O.J. Simpson verdict was the animosity Simpson's lawyers had for each other. Superlawyer F. Lee Bailey pulled no punches when he insulted Robert Shapiro. Said Bailey: "Shapiro was a one-man office with one secretary who know only WordPerfect—the old Word-Perfect—and he was in way over his head."

If your entry is used, we'll send you \$50 and a *PC Magazine* T-shirt. Send your entries to Abort, Retry, Fail?, *PC Magazine*, One Park Ave., New York, NY 10016-5802. Winners this issue: David Boettger, Mark Estes, John Kacprzak, Edward Mendelson, Robert Morningstar, and Miriam Otte.

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